ORTEC®

AlphaVision®-32

Alpha Particle Spectrum Acquisition and Analysis forMicrosoft® Windows® 2000, XP® Professional, Vista® Ultimate, and Windows 7

A36-B32
Software Version 5.6

Installation, User Interface, and Reference Guide

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NOTE!

We assume that you are familiar with 32-bit Microsoft® Windows® usage and terminology. If you are not fully acquainted with the Windows environment, read the Microsoft documentation supplied with your Windows software and familiarize yourself with a few simple applications before proceeding.

The convention used in this manual to represent actual keys pressed is to enclose the key label within angle brackets; for example, **<F1>**. For key combinations, the key labels are joined by a + within the angle brackets; for example, **<Alt + 2>**.

1. INTRODUCTION

Welcome to ORTEC's AlphaVision v5.6, the 21st-century approach to PC-based alpha spectroscopy. We have designed AlphaVision to enhance and simplify your alpha-spectrometry projects in almost every way. AlphaVision v5.6 includes features for managing virtually all alpha-spectrometry projects, covering each of the necessary steps and providing features that will enhance your results. The AlphaVision v5.6 software is divided into four major modules that follow the alpha-spectrometry process:

- Calibration
- Batching, counting samples, and reporting
- Hardware
- Quality Assurance/Quality Control

These activities are quite distinct from one another so each has its own user interface. Therefore, each has an icon on the *Outlook Bar* on the left side of the screen so you can switch easily from one interface to another. In this manual, we refer to these separate interfaces as *modes* or *modules* (e.g., the *Calibration mode* or *Calibration module*). Data management is of course the heart of AlphaVision so its functions are tightly interwoven with all 4 modules (hence, there is no separate "Data Management" module).

1.1. About this Manual

This manual is designed to help you begin using AlphaVision v5.6 today. It is an adjunct to the HTML Help Manual, a comprehensive, on-screen manual integrated into AlphaVision v5.6. To access the complete help manual, start AlphaVision and click on **Help/Contents**. The HTML Help Manual navigates like a website, and also includes the traditional help Contents, Index, and word Search tabs.

The core of this manual is a comprehensive, 6-step tutorial that takes you through all of Alpha-Vision v5.6's major features including the library, tracer, QA Type, and ROI editors; calibration, batch, and background analysis wizard setup. Read through it and explore the software, or actually perform the example calibration, detector background measurement, batch analysis, and associated quality control/assurance operations. For detailed information on most topics, you will be directed to the HTML Help Manual.

This guide is organized as follows:

Chapter 1	Introduction to AlphaVision v5.6 and the HTML and paper user manuals; comparison between AlphaVision 5.x and 4.x; new features in AlphaVision v5.6; and the features in the preceding AlphaVision v5 releases.

Chapter 2	Software installation, building the master list of detectors, and network configuration.
Chapter 3	Overview of the new AlphaVision v5.6 user interface, including the library and calibration source editors, acquisition-setup wizards, spectrum and analysis display, QA tools, and reporting options.
Chapter 4	Overview of AlphaVision's data management tools, including the table structures for building a LIMS-to-AlphaVision interface.
Chapter 5	Tutorial; a solid, step-by-step introduction to using AlphaVision v5.6's major capabilities.
Chapter 6	A checklist of required startup tasks before you begin analyzing samples with AlphaVision v5.6.
Chapter 7	Analysis methods.
Appendix A	Data export example in Microsoft Visual Basic.

1.2. AlphaVision 5.x Features

AlphaVision Version 5 is a major step forward in power and flexibility, and encompasses almost every aspect of alpha spectrometry:

1. Control and monitor up to 256 detectors on the AlphaVision "Detector Grid" display.

2. All features are intuitive "point and click," and use familiar Windows menu and command operations.

3. Simple wizard-based calibration, sample, and background analysis setup.

4. Analysis-setup *templates* let you "set and forget" for reliable, consistent analyses. When you no longer need a template, you can delete it.

5. Dynamic detector, chamber, calibration, and process QC monitoring.

6. On-screen, comprehensive, fully illustrated HTML User Manual navigates like a website and has contents, index, and advanced word search.

7. LIMS in-and-out data handling capability – you can enter sample information or build an interface between your LIMS and AlphaVision that will take care of it.

8. Integrated control of Oxford® OASIS alpha spectrometers.

9. An optional setup feature allows you to specify chamber pressure, bias, and leakage current thresholds above which AlphaVision 5 automatically suspends data acquisition. When these parameters fall below the threshold, counting automatically resumes.

10. Count to live-time, real-time, and MDA presets. AlphaVision 5 gives you count-to-MDA with real-time assessment of the MDA based on the actual recovery, not on an estimate! A great tool for the spectroscopist who wants to maximize detector capacity.

11. "Modify Acquisition Presets" feature allows you to add more counting time to a sample the analysis is complete, so you don't have to start over.

12. Spectral data are saved automatically by AlphaVision 5 so already-collected data survive a power failure, system crash, or other major interruption. In fact, if only the PC shuts down, data collection continues. Once you reboot the computer and restart AlphaVision, it interrogates the hardware, updates accordingly, and continues.

13. Enhanced ability to create QC Control Charts. You can rapidly create a Control Chart for a specific client, period of time, or isotope; and for controls, blanks, backgrounds.

14. The Batch Wizard allows you to add reagent blanks and control samples to batches.

1.2.1. Comparison to AlphaVision 4

Like AlphaVision 4, AlphaVision 5.x uses an Access database for data archive. It remains compatible with SAP® BusinessObjects Crystal Reports™, comes complete with standard reports for Analysis, Calibration, Background, Pulser Tests, and QA/QC. These features are designed to dramatically enhance your existing data handling processes. Most of the operation features of AlphaVision 5.x are completely new, plus all spectra, analysis, and QA data are now stored in a database rather than in individual **.SPC** files. This results in improved data manageability, efficiency, and flexibility.

In place of sample types, AlphaVision 5.x uses easy-to-set-up *templates* that contain your predefined acquisition, analysis, and reporting preferences. The new Batch Wizard contains user-defined fields for batches, individual samples, and client/contact management; allows you to include controls and blanks within batches, as well as set up serial dilutions; and can accept batch information from your Laboratory Information Management System (LIMS).

1.3. What's New in AlphaVision v5.6

The information here and in the remaining sections of this chapter serve two purposes: for existing AlphaVision 5.x users updating to v5.6, Section 1.3 highlights new features and functionality. For users new to AlphaVision 5.x, all these sections serve as supplements to the software's integrated HTML Help Manual (which is accessed within AlphaVision via the **Help/Contents** command). AlphaVision v5.6 now supports the "short date format" selected as your Windows regional setting. This date format is now applied to the following items:

- Decay, sample collection and lab preparation date and time
- Spectrum acquisition date time
- QA results date and time
- Detector calibration/analysis date and time
- Tracer certificate creation date and time
- Analysis library creation date and time
- Calibration library creation date and time
- Control solution creation date and time
- Date and time in the QA chart
- All the date and time strings on the Crystal Reports (5 types of reports)
- All the date and time strings in the event window
- All the date and strings in the sample search dialog
- All the date and strings in the QA custom display dialog

NOTE The default Batch Calibration and Batch Sample names are still fixed in the original YYYY.MM.DD nnn format (e.g., 2011.01.01 005, indicating the fifth batch created on January 1, 2011).

1.4. Features Introduced in v5.5

Overview of v5.5 features:

- New analytical methods and tools
- Improved organization of background and QA pulser batches
- Quick search for a specific batch or sample
- Easier batch setup
- New activity units and volume units
- Changes to reporting
- Export spectra from the Batch Explorer to ORTEC .SPC spectrum files
- Easier QA limits setup
- Enhanced security

- A new database management tool for QA results
- MAESTRO®-32 is no longer a required component for AlphaVision v5.x operation

1.4.1. New Analytical Methods and Tools

1.4.1.1. New Peak Search for Low-Count, Asymmetric Peaks

AlphaVision v5.5 introduces a new peak search/fit methodology for use when you *must* fit a peak, even when count statistics, poor shape, or overlap could make it a poor candidate for the standard AlphaVision peak search/fit algorithm. It uses an ROI Set to direct the analysis to certain regions of the spectrum, as well as an iterative peak stripping technique. To use this method:

Create an **ROI Set** that defines each region in which a peak of interest will be located.

In the Batch Wizard, select **Peak Search/Fit** as the analysis method on the Analysis Setup page of the Batch Wizard, then specify the appropriate **ROI Set**. (If no ROI Set is specified, AlphaVision v5.6 uses the default peak search/fit algorithm.)

The new routine starts with the highest-energy ROI in the set, and calculates a peak fit based on the contents of the ROI. The counts in the fitted peak are stripped from the spectrum. The routine then moves to the next-highest-energy ROI in the set and repeats the peak fitting and stripping. When all ROIs in the set have been analyzed in this way, the remainder of the spectrum is analyzed according to the standard peak search/fit criteria.

1.4.1.2. Manual Chemical Recovery

AlphaVision v5.5 provides an additional method for determining chemical recovery. The Analysis Setup page of the Batch Wizard includes a **Manual CR (%)** feature. It allows you to enter a percent chemical recovery, determined by an alternative method (e.g., a gamma counting technique), and apply it to all samples in the batch. See Fig. 139 and the discussion on page 118.

1.4.2. Improved Organization of Background and QA Pulser Batches

The v5.5 Sample Explorer now introduced the same organizing tools for Background and QA Pulser samples as for sample batches. Simply right-click and select **Insert Branch** to build background and QA pulser hierarchies (Fig. 1). Accordingly, the Background Wizard, and QA Pulser Wizard include a Batch Properties screen that lets you specify the “location” of the batch in the database. See also Section 5.1.5.1, which describes the process for Batches.

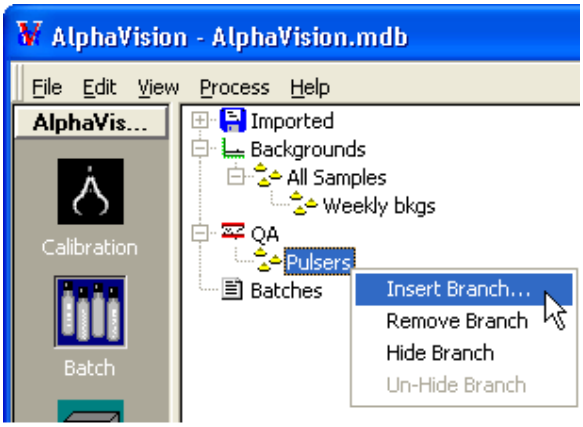


Fig. 1. Build Sample Hierarchies for Background and QA Samples.

1.4.2.1. View Batch Explorer Entries in Ascending or Descending Order

The **Sort Descending** command has been added to the **View** menu. Selecting it re-sorts the Batch Explorer Tree, reversing the order of the sample categories (e.g., Imported, Background, QA, Batches), and sorting the entries in each category newest-entry-first. Unmarking **Sort Descending** returns the sample categories to their original order, and sorts the entries oldest-entry-first. Figure 2 compares the original ascending and new descending sorts.

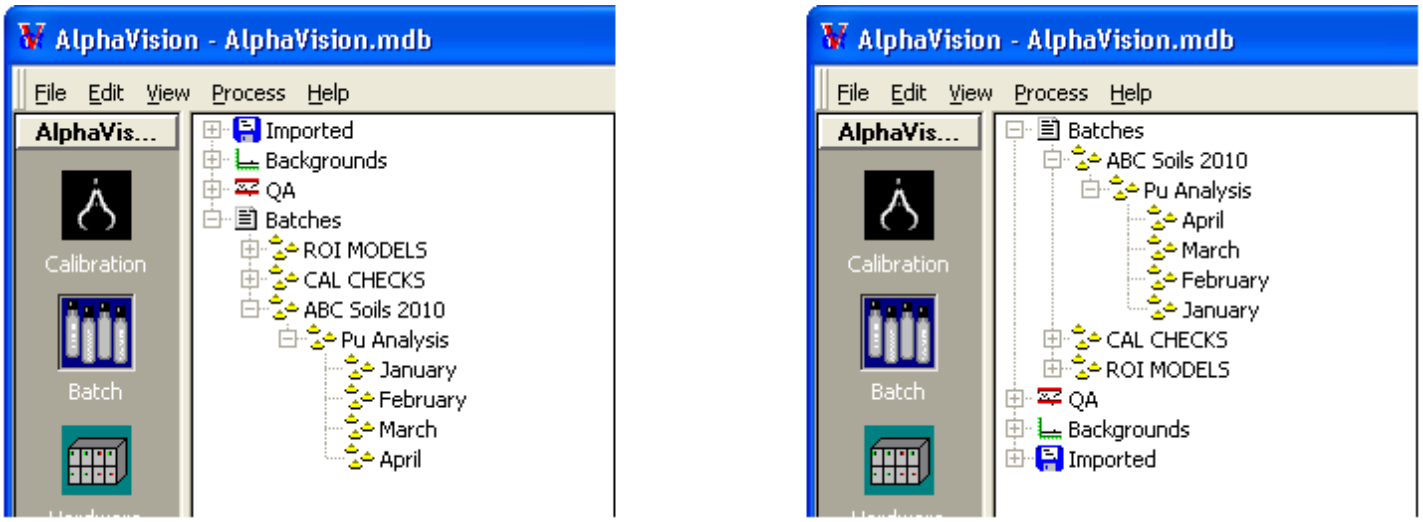


Fig. 2. Batch Explorer Tree Sorted in Ascending and Descending Order.

1.4.3. Quick Search for a Specific Batch or Sample

The **Edit** menu in Batch Mode has a new **Search** command that helps quickly locate a specific ***unhidden*** batch or sample in the current database. *All data categories in the Batch Explorer panel are searched, including imported records.*

Before selecting **Edit/Search**, decide whether to (1) search all entries in the Batch Explorer panel by turning **View/Hide Branch** off; or (2) use the **Hide Branch** and **View/Hide Branch** commands to mask certain parts of the database from this search tool.

Select **Edit/Search**. Choose either **Batch** or **Sample**, then narrow the search by entering all or part of the record **Name** and/or a range of dates. If your database is large, you may also wish to specify the **Max**imum number of records to be retrieved. Click on **Search** to generate the list of records matching your criteria. The **Found** field shows the number of hits.

Locate the desired **Batch Name** or **Sample Name** in the results list, then double-click on it or highlight it and click on **View**. See Fig. 3. When you select a batch for viewing, its component samples are displayed in the Sample Explorer panel. When you view a sample, it is highlighted in the Sample Explorer, and its spectrum is displayed.

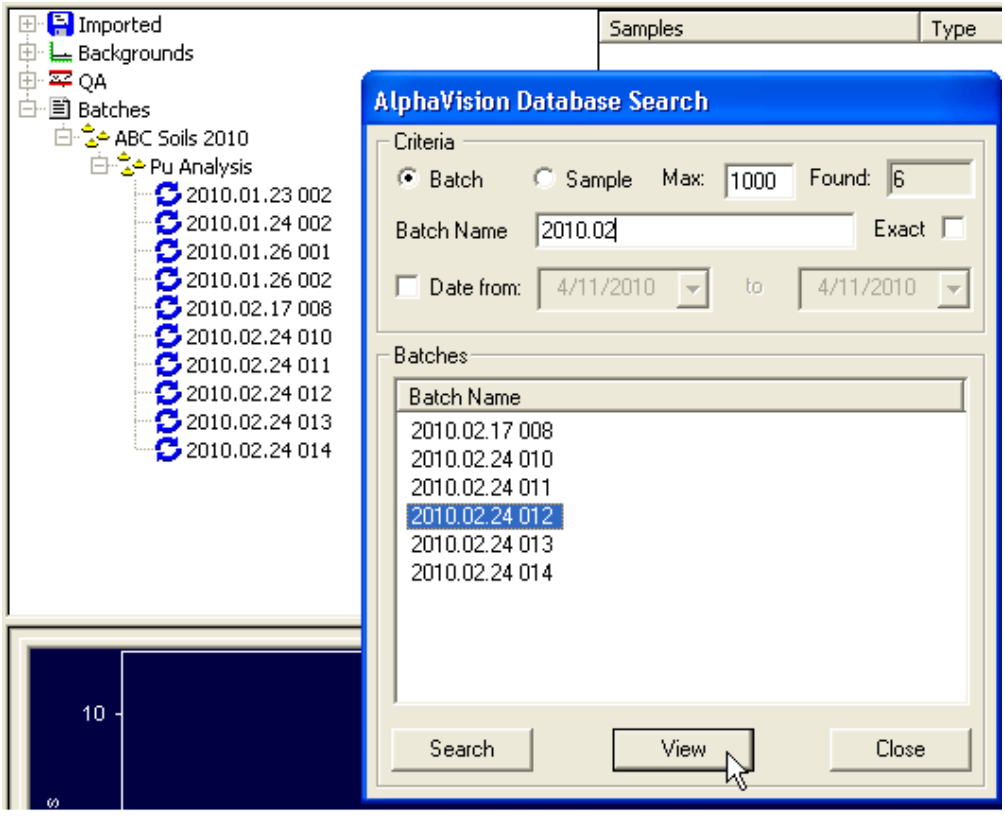


Fig. 3. Quickly Locate and Display a Specific Batch or Sample Record.

1.4.4. Easier Batch Setup

1.4.4.1. Auto-Define Samples in the Analysis Wizards

The Batch, Background, and QA Pulser wizards now includes an “auto-sample” feature that reduces your batch setup time. To use this new feature, go to the wizard’s Sample page

and click on the auto-sample button (**...**) below the Sample Names panel (refer to Fig. 5). AlphaVision v5.6 will poll the system, return the list of currently available detectors (i.e, those calibrated and available for counting), let you select the detectors to be used, then automatically populate the sample list, one per detector. The samples names are based on the detector names.

You can then modify, add, or delete samples as needed. Figure 5 shows the automatically populated samples based on the detectors listed in Fig. 4.

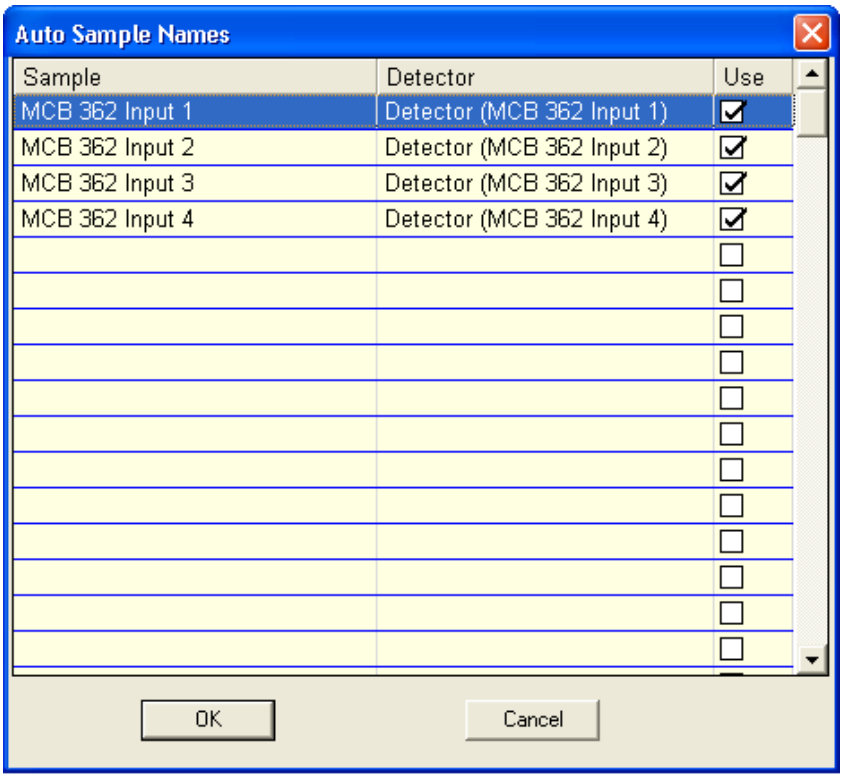


Fig. 4. List of Available Detectors For Automatic Sample Naming.

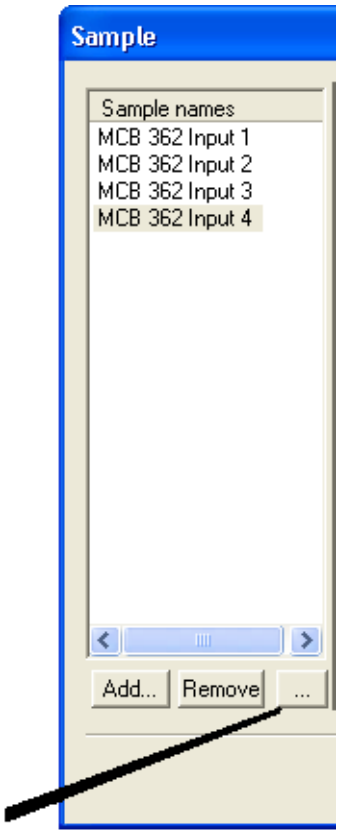


Fig. 5. Sample Names Assigned Based on List of Available Detectors.

1.4.4.2. Create Sample-Less Batch Templates

Earlier releases of AlphaVision 5.x required you to assign at least one sample when defining a new template. The Batch, Background, and QA Pulser wizards now allow you to create new templates without assigning any samples. This makes it easy to set up one or more templates at the outset of a project, before you are ready to begin batching. The General page now includes a **Create Template without Samples** checkbox. Mark the **Save As Template** box, then mark this new box, assign a template name, and begin stepping through the wizard. The wizard's Batch page does not require you to choose a location for the batch, and the Sample page does not require you to define samples. All other setup steps are the same.

1.4.4.3. Differentiate Blanks by QA Type

The MDA/Blank page of the Batch and Background wizards (see Section 1.5.8) has a new listbox that makes it easier to locate the blank spectrum needed for your analysis. Choose the desired Reagent Blank QA type from the **Sort Blanks** list (Fig. 6), then select the **Blank Spectrum** to be used (Fig. 7).

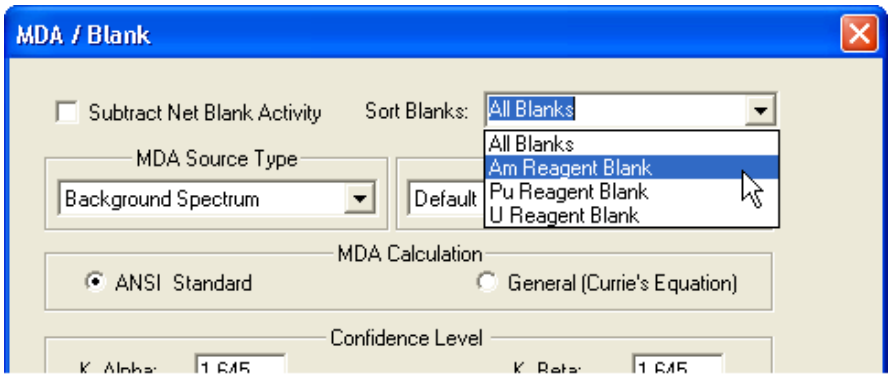


Fig. 6. Select a Reagent Blank QA Type.

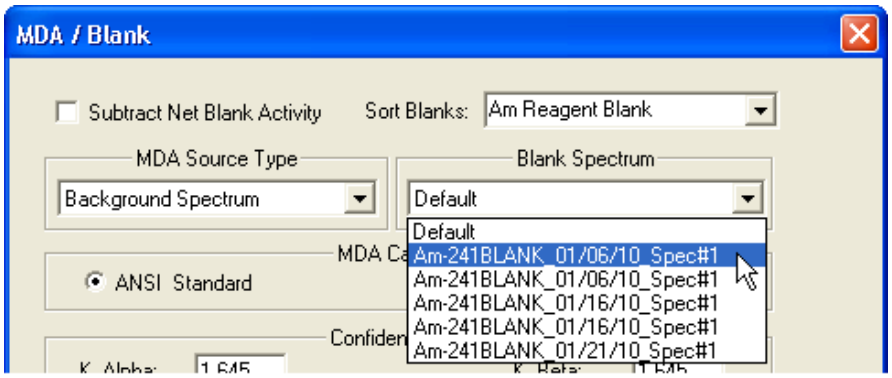


Fig. 7. Choose the Blank Spectrum.

1.4.5. New Activity Units and Volume Units

This release of AlphaVision gives you more choices for activity units of measure in the Tracer Editor, Calibration Source, and Control Solution editor dialogs (Fig. 8). Choose from disintegrations per minute (DPM), curies (Ci), millicuries (mCi), microcuries (µCi), nanocuries (nCi), picocuries (pCi), fempto-curies (fCi), millibecquerels (mBq), becquerels (Bq), and kilobecquerels (kBq). The default is DPM.

In addition, the Analysis Setup page of the Batch Wizard now lets you enter the tracer amount in grams (g) or milliliters (mL). See Fig. 139 on page 117.

Finally, you can now define volume on the Control Solution editor (Section 5.1.4.1) n grams (g) or milliliters (mL).

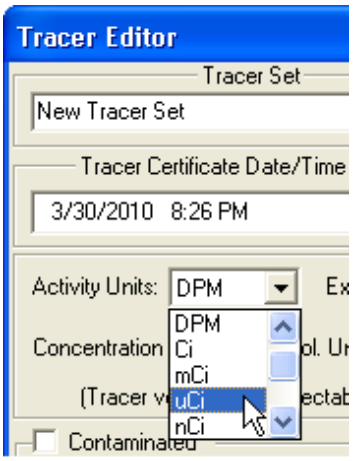


Fig. 8. Expanded List of Activity Units.

1.4.6. Changes to Reporting

1.4.6.1. Report Reanalysis Results with Your Custom Report Templates

The Re-Analysis Setup dialog (for analyzing batches and reanalyzing individual samples) now has a new Report tab (Fig. 9) with a **User Defined Template** section that lets you generate reports from your custom Crystal Report templates.[1] Mark the checkbox, then browse to locate the desired template. (To produce reanalysis reports with the default AlphaVision template, use the Report Window.)

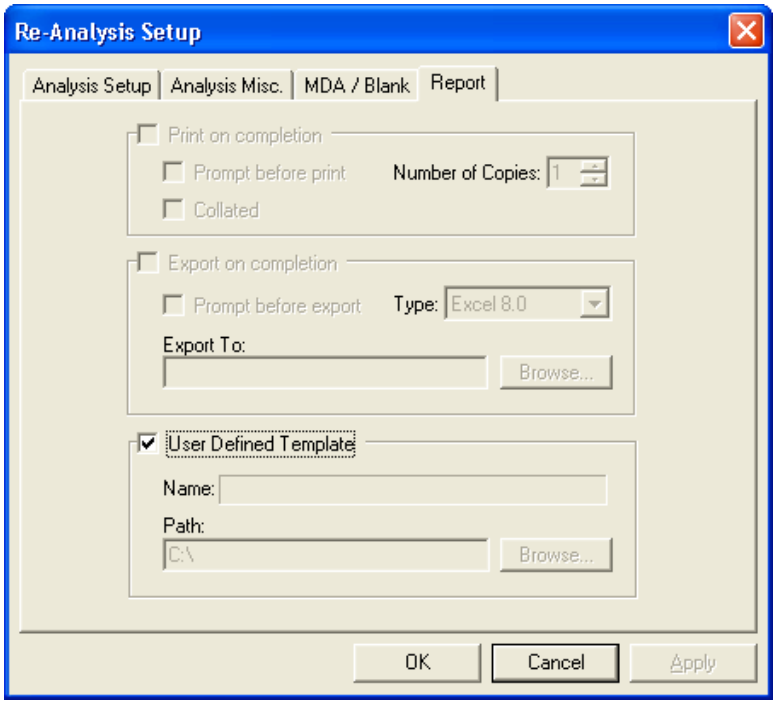
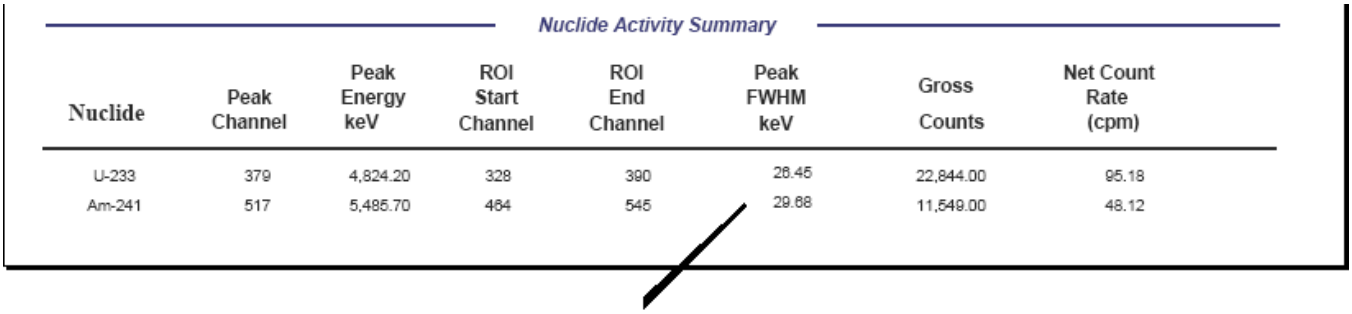


Fig. 9. Use Custom Templates in Reanalysis Reports.

[1]This requires Crystal Reports v11, not supplied with AlphaVision v5.6. We can assist in developing custom templates; contact your ORTEC representative or Customer Support for more information on this service.

1.4.6.2. Peak FWHM Added to the Calibration Reports

The Nuclide Activity Summary section of the Calibration report now includes the FWHM for each identified peak (Fig. 10). If you have an earlier version of AlphaVision 5.x, you can generate a report showing this new parameter by updating the analysis or calibration.



Nuclide Activity Summary

Nuclide	Peak Channel	Peak Energy keV	ROI Start Channel	ROI End Channel	Peak FWHM keV	Gross Counts	Net Count Rate (cpm)
U-233	379	4,824.20	328	390	28.45	22,844.00	95.18
Am-241	517	5,485.70	464	545	29.68	11,549.00	48.12

Fig. 10. New Peak FWHM Column.

1.4.7. Export Spectra from the Batch Explorer to ORTEC .SPC Spectrum Files

AlphaVision v5.5 lets you export spectra as **.SPC**-format spectrum files, which can then be viewed and manipulated in our CONNECTIONS-32 applications, such as MAESTRO-32 or GammaVision-32. To do this, right-click in the Batch Explorer Panel on the desired spectrum (🗠) (Fig. 11) then choose **Export** from the right-mouse-button menu. A message box will display the name of the new spectrum file. All **.SPC** files are exported to the **C:\User Programs\AlphaVision** folder. Filenames are based on the batch name, sample name, and comment string.

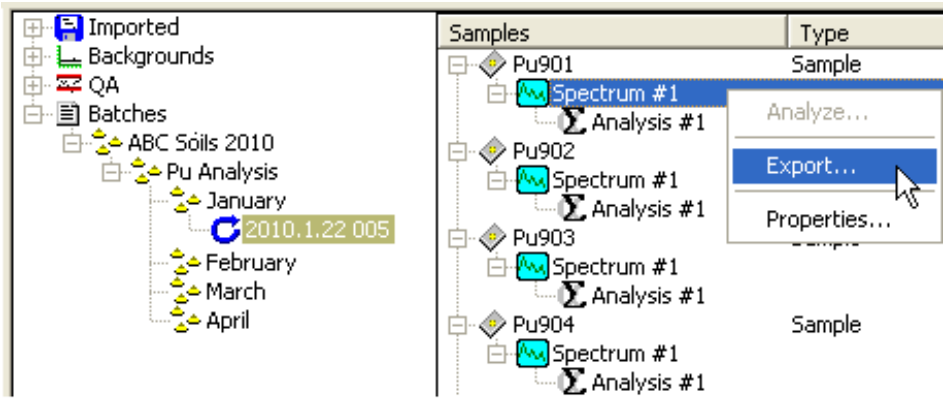


Fig. 11. Export Spectra as .SPC Files.

1.4.8. Easier QA Limits Setup

The v5.5 **All Detectors** checkbox on the QA Limits panel lets you click once to assign all detectors in your system the same QA limits for a particular parameter (such as total

background). Choose a detector, set the warning and alarm limits for the desired parameter, mark the corresponding checkbox, then click the **Apply Changes** button (Fig. 12). Note also that **Total Background** is now expressed on this panel in counts per day (c/d).

1.4.9. Enhanced Security

As of v5.5, only users at the **Administrator** security level can access the database management tools, including the ability to select a different working database. For all other users, the database commands are disabled.

In addition, two new access permissions have been added to the Security Levels dialog:

- **Save Batch Template** — Users without this permission cannot create templates in Batch Mode.

- **Move Detectors** — Users without this permission cannot move detectors on the Detector Grid.

See also Section 3.1 and the HTML Help Manual.

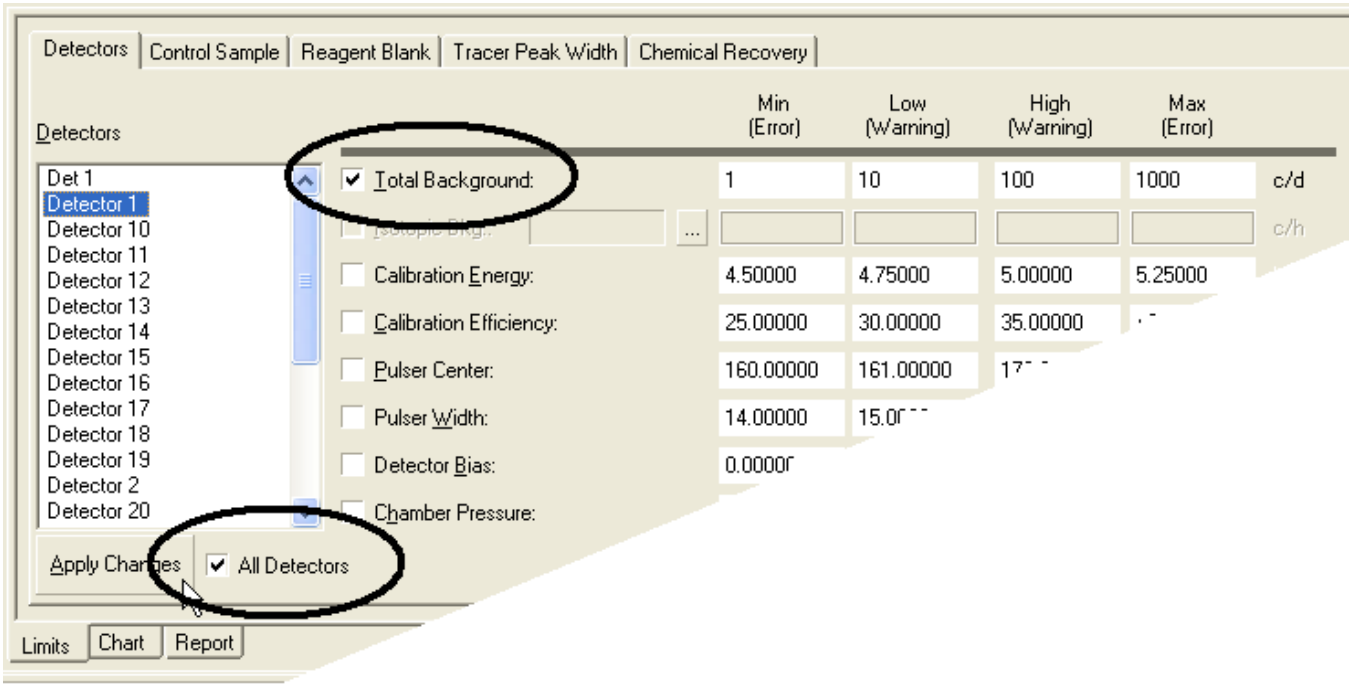


Fig. 12. One Click Sets A QA Limit for All Detectors.

1.4.10. New Database Management Tool for QA Results

In earlier versions of AlphaVision v5.x, the Database Management dialog only allowed you to manage the data listed in the Batch Explorer tree. However, the database also holds QA pulser and QA background data. As of v5.5, you can view and/or delete those data by clicking on the QA Results **Edit** button to open the QA Results Management dialog shown in Fig. 13. Use the listbox at the top of the dialog to view either pulser records or background records.

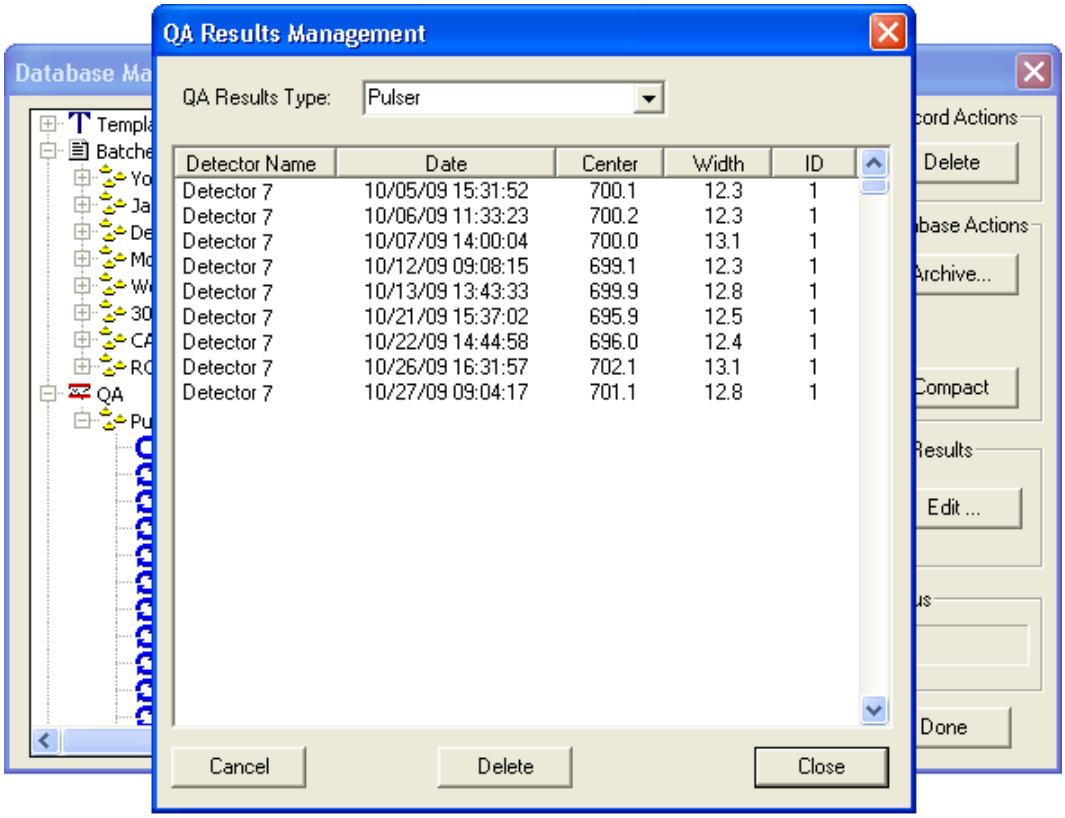


Fig. 13. Manage QA Pulser and QA Background Records.

1.4.11. MAESTRO®-32 No Longer a Required Component

As of v5.5, AlphaVision no longer requires installation of the accompanying ORTEC MAESTRO®-32 MCA Emulation software.[2] Note, however, that MAESTRO is necessary to set up and monitor alpha chambers other than ORTEC Alpha-series (Aria®, Duo™, Ensemble™) or OCTÊTE-series instruments, and the Oxford OASIS.

You may also find MAESTRO useful for performing quick counts for methods development work, test sources, and source activity checks *outside of the AlphaVision program*. Data

[2]Exception: If you purchased a new ORTEC alpha spectroscopy MCB, in addition to AlphaVision v5.6, be sure to install MAESTRO-32 and other accompanying software according to the instructions in the hardware manual.

collected in MAESTRO are not stored in the AlphaVision database; however, they can be saved within MAESTRO, as discussed in its *Software User Manual*. See also Section 3.2.10 of this manual.

1.5. Features Introduced in AlphaVision v5.3

1.5.1. ROIs Expressed in Channels or Energy

In Batch and Background modes, AlphaVision v5.6 now lets you define ROI Sets either in channels or energy (keV) by marking the **Define ROIs in Energy (keV)** checkbox in the upper right corner of the dialog, as illustrated in Fig. 14. In Calibration mode, ROI Sets can only be defined in channels. *You must choose the unit of measure before clicking on the **Update** button.* For instructions on building ROI Sets, see “Creating an ROI Set for This Calibration Record,” on page 85.

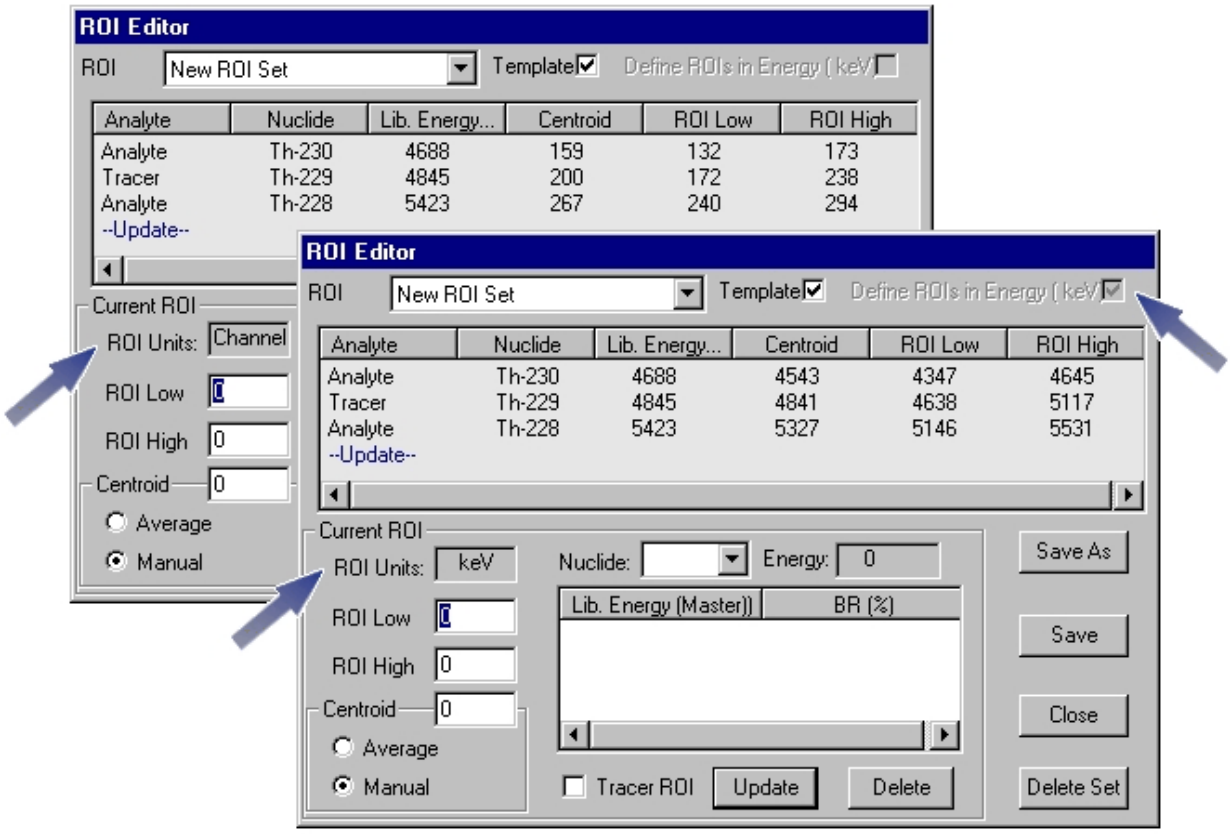


Fig. 14. ROI Sets Expressed in Channels or Energy (keV).

1.5.2. Select Database and Database Management

AlphaVision v5.6 allows you to choose the target database for all of your project measurements with the **File/Select Database...** command discussed in Section 4.2. In addition, AlphaVision now contains a suite of database management tools that give you comprehensive control over the contents of your AlphaVision databases. See Section 4.3 for complete information.

1.5.3. Sample Dilution Setup in the Batch Wizard

The Sample setup page of the Batch Wizard now includes a dilution feature that helps you set up and track a 1- or 2-stage dilution. All you do is fill in the aliquot and sample volumes (and any associated uncertainty), then click on the **Calc. Dilution** button at the bottom of the calculator.

To measure all of the sample, click on the **Total** radio button, then enter the **Sample Amount** (as volume or weight, set with the **Sample Units** radio buttons in the upper right corner of the dialog) and uncertainty. This is illustrated in Fig. 15. Note that the **Calc. Dilution** button is inactive.

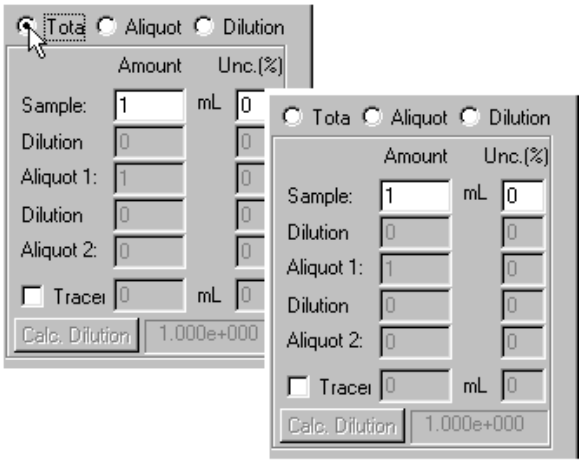


Fig. 15. Using All of the Sample. (The Calc. Dilution button is inactive in this mode.)

To use an aliquot of the sample, click on the **Aliquot** radio button, then enter the amount and uncertainty of the total **Sample** and of the **Aliquot** (Fig. 16). The **Calc. Dilution** button is also inactive in this mode.

If you will be diluting your sample, select the **Dilution** radio button to activate all of the fields and enable the **Calc. Dilution** button (Fig. 17). This section of the screen supports two dilutions. Enter the appropriate amount and uncertainty for your total sample, the volume into which you have diluted it, and the aliquot to be measured, then click on **Calc. Dilution** to perform the arithmetic. You can click on the calculation button as often as you wish while setting up the dilution(s), but be sure to click it one final time when all of the dilution and aliquot information has been entered.

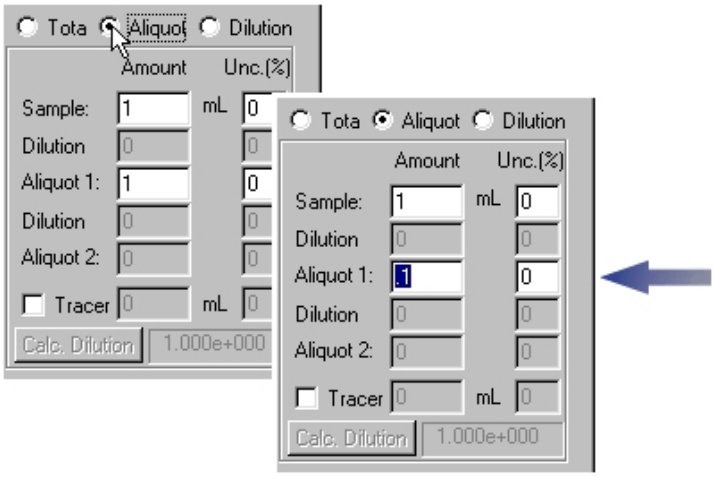


Fig. 16. Using an Aliquot of the Total Sample. (The Calc. Dilution button is also inactive in this mode.)

Figure 17 shows a **Sample** volume of 1.0 mL being diluted into 10 mLs (a dilution of 1:10, denoted in the **Dilution** calculation field as *1.000e+001*). A 0.1-mL **Aliquot** is subsequently diluted into 100 mL, then a 0.1-mL aliquot — a final dilution of 1:100000 — is taken for the sample measurement.

The **Tracer** feature works as it did in earlier releases of AlphaVision 5. If you are adding different amounts of tracer to each sample in the batch (rather than a uniform amount in all samples), mark the **Tracer** box here and enter the amount and uncertainty on a sample-by-sample basis. If you are adding a uniform amount to all samples in the batch, use the **Relative Analysis** feature (see Fig. 144, page 121).

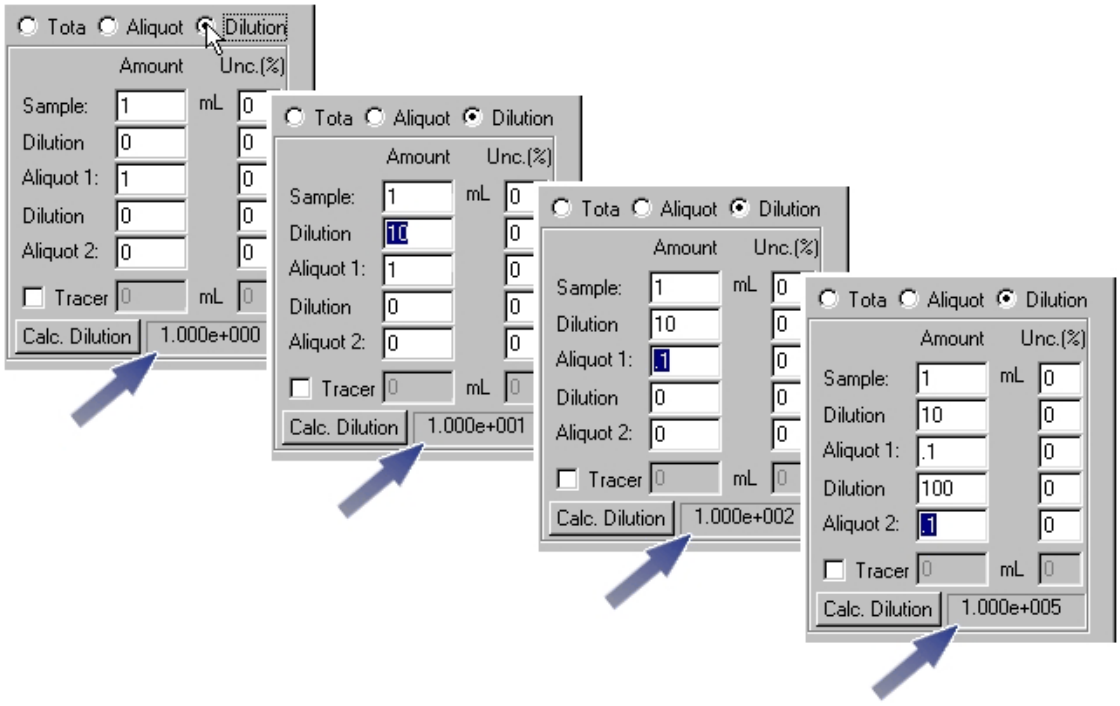


Fig. 17. Calculating the Dilution as Dilution and Aliquot Information are Entered.

1.5.4. New Scaling and Cursor Movement Features

AlphaVision v5.6 spectrum windows now use many of the horizontal and vertical scaling and cursor movement keys employed in our other spectroscopy products (e.g., MAESTRO-32), including:

- Move marker one channel left/right, <←>/<→>
- Taller/shorter, <↑>/<↓> and <**F5**>/<**F6**>
- Narrower/wider <**F7**>/<**F8**>.
- Zoom in/out **Keypad**<+>/**Keypad**<−>.

NOTE *These keys only function when the Thumbnail window is **closed**.*

See Section 3.2.7 for more detailed descriptions of these commands.

1.5.5. Interactive ROI Analysis in Batch, Background, and Calibration Modes

In previous versions of AlphaVision 5, if you were using multiple detectors, depending on the gain and shift settings for each device, you might have had to create multiple ROI Sets to accommodate detector-to-detector differences, or else repeatedly edit a single ROI Set. AlphaVision v5.6 now offers an *interactive ROI analysis* that allows you to create just one ROI Set for your multiple detectors; quickly adjust its ROIs, "on the fly," for a particular detector; then replace that detector's original analysis with an ROI analysis using the customized ROI Set (this capability cannot be used for the initial spectrum analysis, only for reanalysis). *The original ROI Set is not changed*. Regardless of the original analysis method, this function performs an **ROI Based** analysis with the **Recalibration** and **Adjust ROI** features turned off. The ROI information for each customized ROI Set is saved in the database and printed in the *Nuclide Summary (ROI)* section of the report.

The details of the process are different for Batch/Background analyses and for Calibrations: In batches and backgrounds, adjusting an ROI's boundaries and centroid simply repositions the ROI. However, in Calibration mode, adjusting an ROI recalculates the detector calibration; this is discussed in more detail in Section 1.5.5.2.

NOTE If you adjust 1 or more ROIs, but then do not execute the **Interactive ROI Analysis** command, the old ROI limits will be restored. However, once the **Interactive ROI Analysis** command has been issued, *there is no undo*.

1.5.5.1. Batch Mode

The following example illustrates how to perform an interactive ROI analysis in Batch mode; the procedure is the same for both Batch and Background data sets.

1. Use the Batch Explorer to locate the proper batch, then locate the spectrum to be reanalyzed. Click on its Analysis entry to display the current spectrum and analysis.

2. In the spectrum window, zoom in as necessary to accurately change ROI boundaries and centroids. Click in the first ROI to be adjusted to activate it. (The active ROI has a dashed border; inactive ROIs have solid borders.) Roll the mouse over the low-channel and high-channel ROI boundaries until the pointer changes to a two-sided arrow, then click and drag the boundaries to reposition them, if necessary (Fig. 18).

3. Next, reposition the centroid, if necessary. To do this, roll the mouse pointer over the small centroid marker until the pointer changes to a four-sided arrow (Fig. 19), then click and drag to the new centroid position. The centroid marker will now indicate the new position (

).

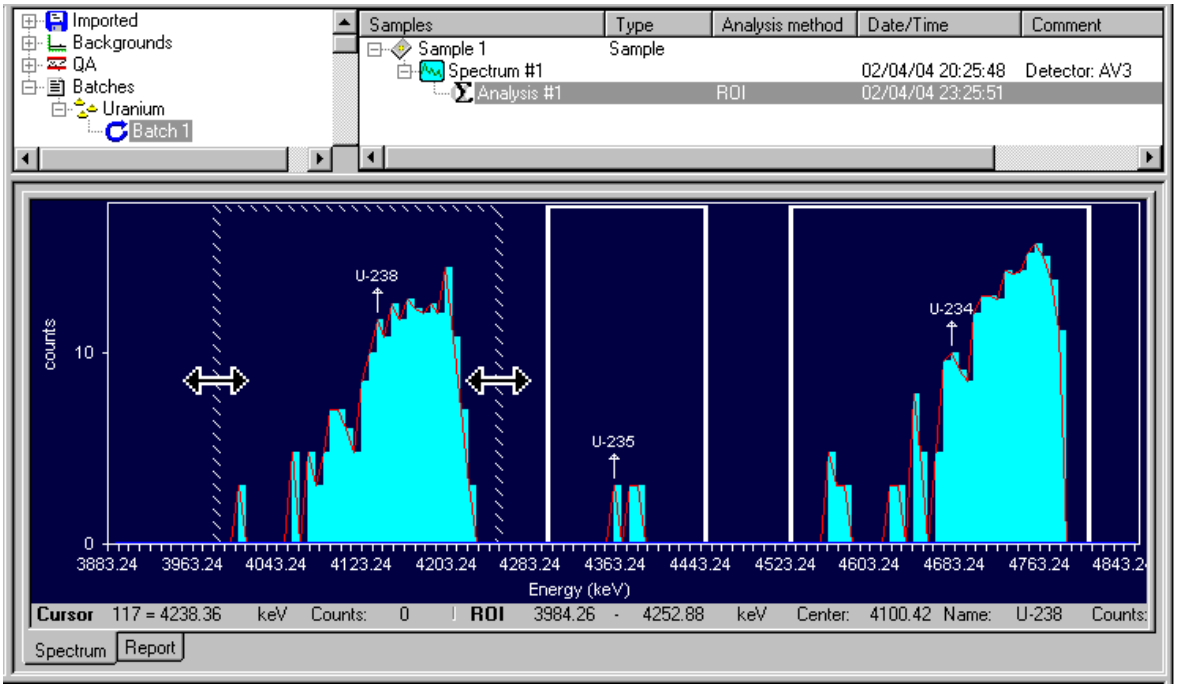


Fig. 18. Click and Drag the Two-Sided Arrow to Adjust the Low- and High-Channel ROI Boundaries. Status line will update to new ROI boundaries.

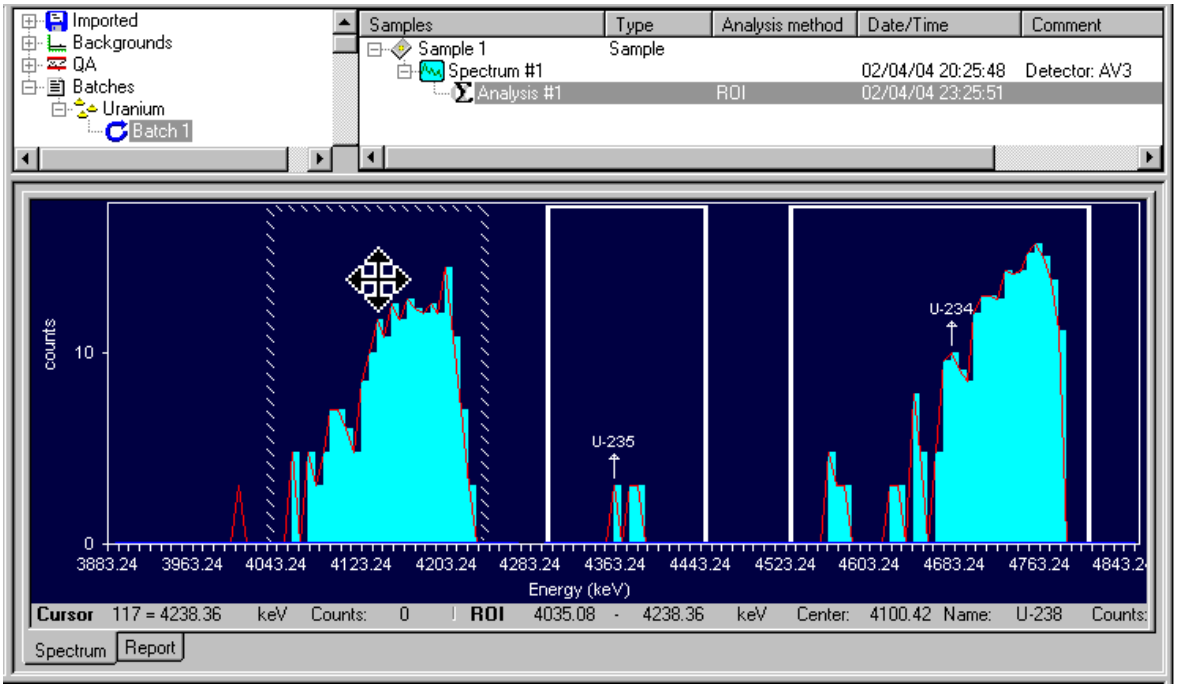


Fig. 19. Click And Drag the Four-Sided Arrow to Reposition the Centroid, If Necessary. Status line will update to show new centroid.

4. You are now ready to reanalyze. Right-click in the spectrum window and select **Interactive ROI Analysis** from the right-mouse-button menu (see Fig. 20). After reanalysis, the energy or channel labels on the X-axis might change.

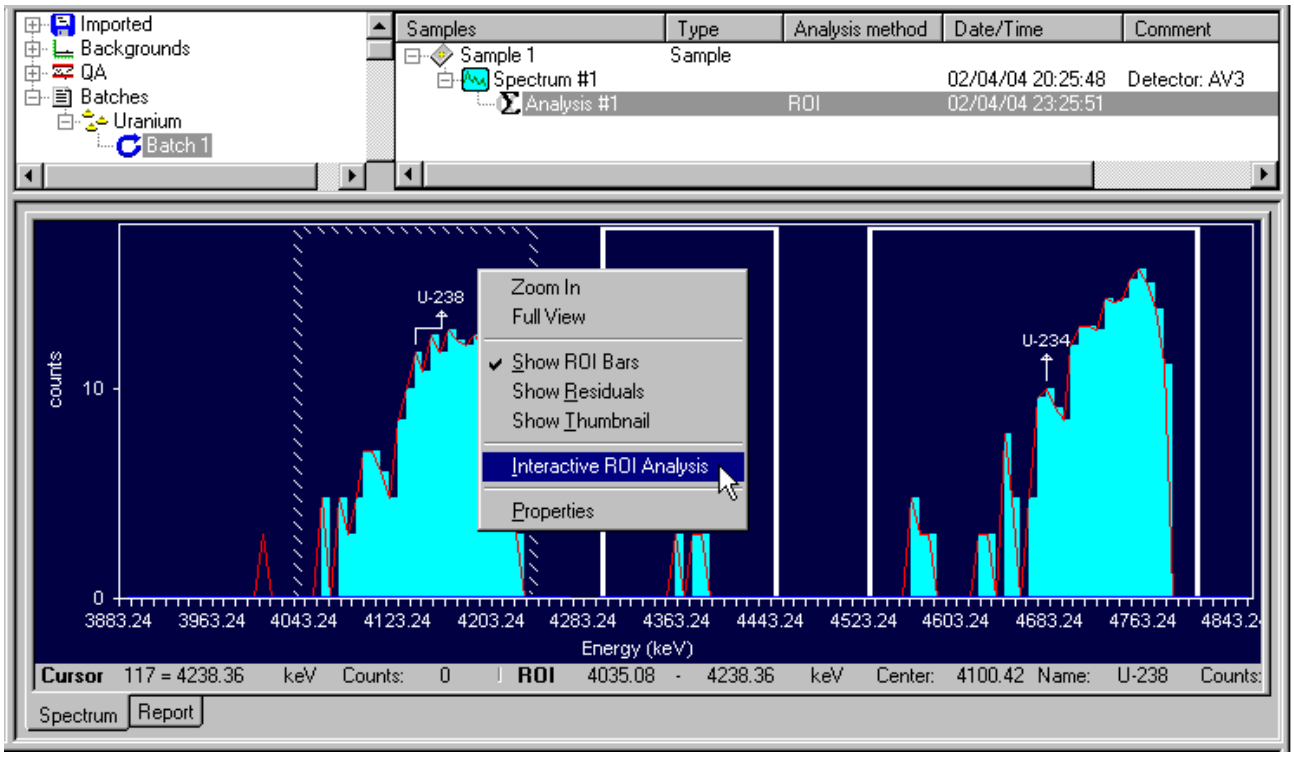


Fig. 20. Right-Click and Select Interactive ROI Analysis to Start the Reanalysis.

5. Figure 21 shows the completed reanalysis. Note that the analysis **Date/Time** in the Sample Explorer has been updated.

6. Right-click on the **Analysis #1** entry and select **Properties** from the right-mouse-button. The Batch Properties dialog will show a grayed checkmark in the **Interactive ROI** checkbox (Fig. 22). This is your indication that this analysis has been performed with a customized ROI Set.

7. To see the peaks in the customized ROI Set, click on the Report tab for this spectrum and look in the *Nuclide Summary (ROI)* section (Fig. 23). *The **Analysis Method** field indicates that an interactive ROI analysis has been performed.*

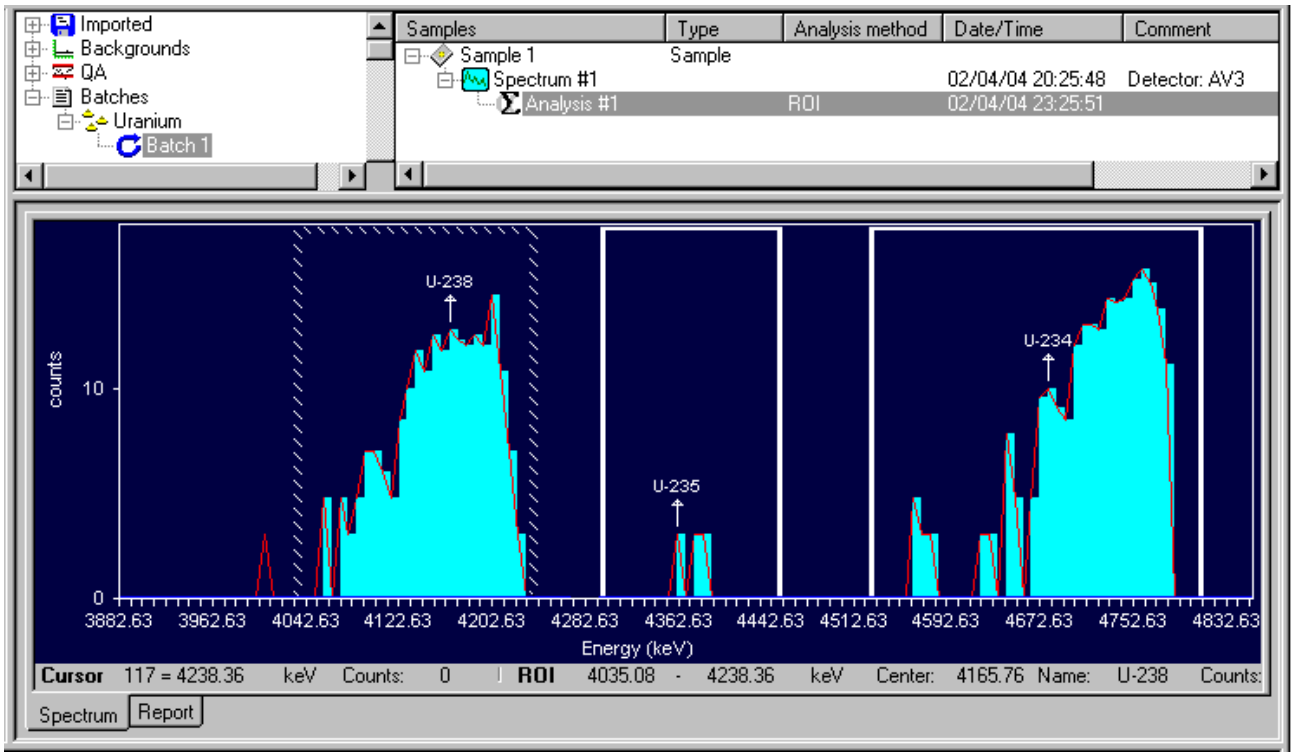


Fig. 21. Reanalysis is Complete and the Analysis Date/Time Has Updated.

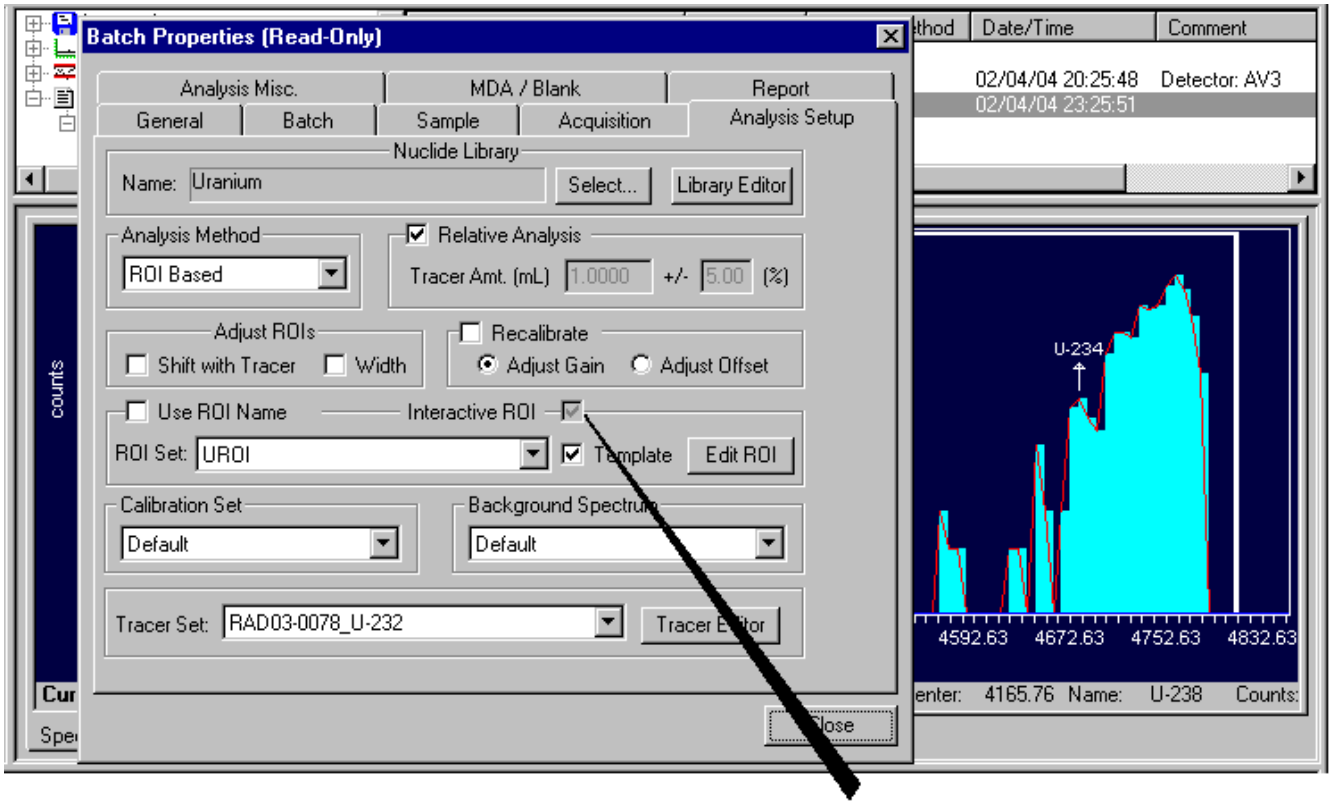


Fig. 22. Analysis Properties for this Sample. Note that the Interactive ROI checkbox is marked, indicating a customized ROI Set. In addition, the Recalibrate and Adjust ROI Width features are turned off. The customized ROIs are listed in the report.

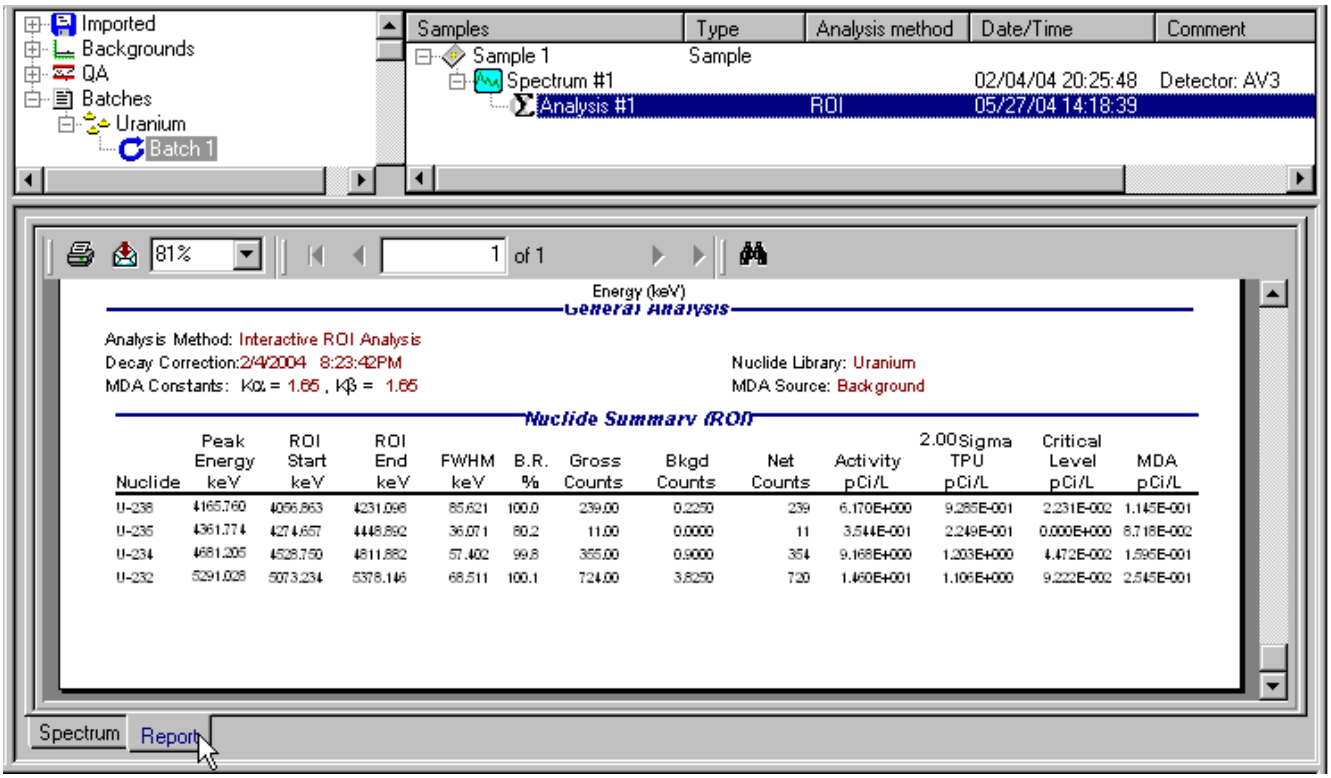


Fig. 23. Report Indicates an Interactive ROI Analysis and Lists the ROIs Used.

1.5.5.2. Calibration Mode

In Calibration mode, adjusting ROIs and issuing the **Interactive ROI Analysis** command triggers a recalibration.

- If you change only the centroid and not the ROI start and end channels, AlphaVision recalculates only the energy, not the efficiency.
- If you change only the ROI start and end channels and not the centroid, AlphaVision will recalculate the efficiency, not the energy.
- Changing both the boundaries and centroid recalculates both calibrations.

1.5.6. The Report: What You See Is What You Get

In preceding AlphaVision 5 releases, the report included the sample spectrum histogram in addition to the standard analytical information. AlphaVision v5.6 allows you to select how much of the spectrum will be displayed on the report: Simply **Zoom In** on the desired spectral features (*use the right-mouse-button menu command, not the Thumbnail*), then click on the Report tab. This is illustrated in Fig. 24.

NOTE The *Nuclide Summary* section of the report always contains the information for all ROIs, not just the ROIs currently displayed in the Spectrum Window.

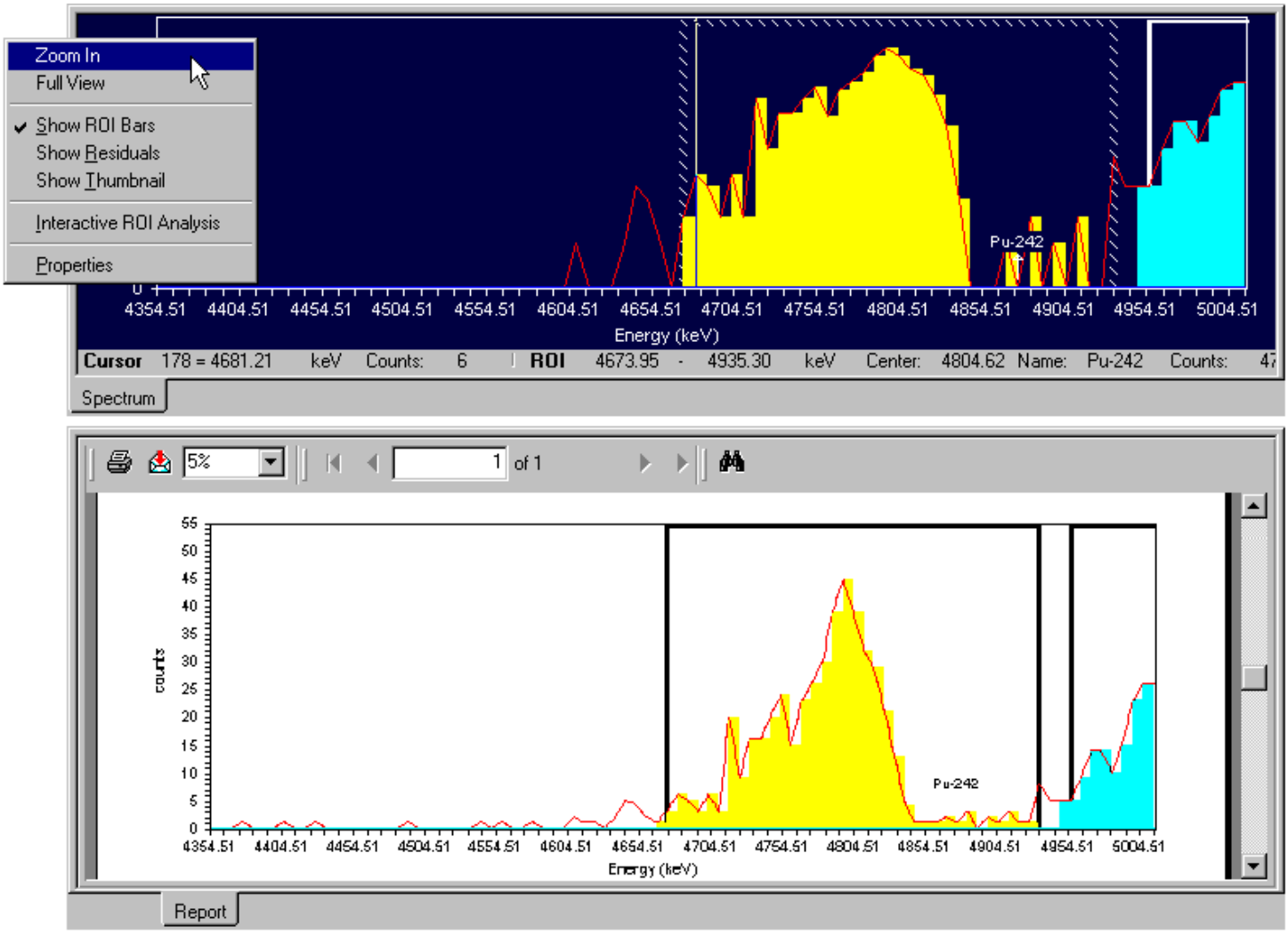


Fig. 24. Zoom In on the Spectrum Window to Determine the Spectrum Display in the Report.

1.5.7. Changes to the Detector Assignment Worksheet

Two new buttons, **Uncheck All** and **Check All**, have been added to the Detector Assignment Worksheet to speed your selection of the samples you wish to count once detectors have been assigned. **Uncheck All** removes all checkmarks from the **Count** column. **Check All** marks all samples for counting.

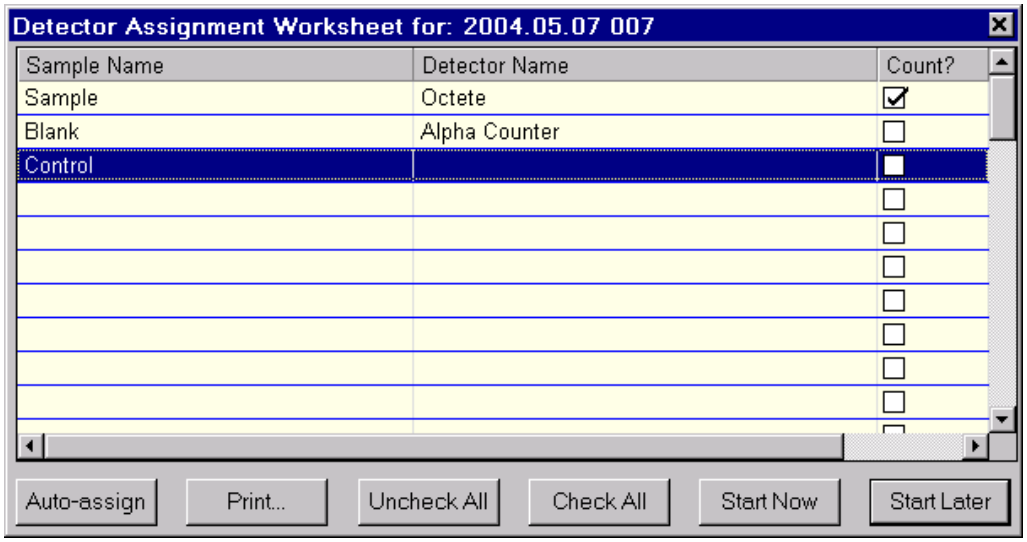


Fig. 25. The Detector Assignment Worksheet.

1.5.8. Subtracting Net Blank Activity

This new feature, located on the MDA/Blank page of the Batch and Background wizards, subtracts the activity (not the counts) for a selected blank from the activity of all samples in the batch. If this batch of samples contains a blank, use the **Default** entry in the **Blank Spectrum** droplist. Otherwise, use the **Blank Spectrum** droplist to select any suitable blank from the current database. If no blank is available, the analysis will fail, in which case you can right-click on the analysis entry Σ, choose **Update Analysis**, and select an appropriate blank (Fig. 26). The calculation is discussed in Section 7.7.12.2.

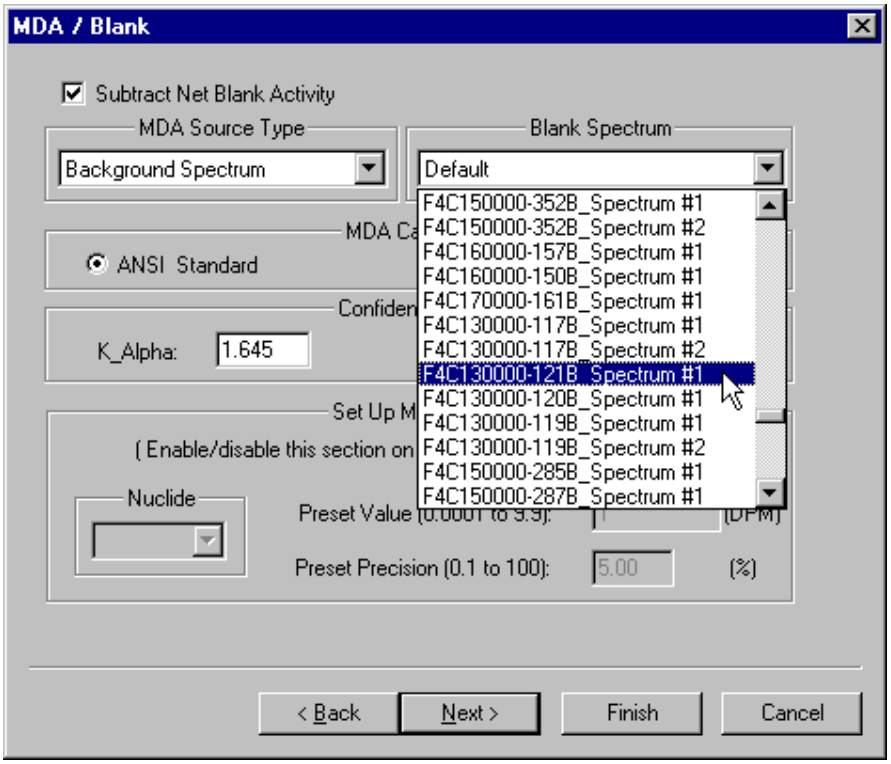


Fig. 26. If Current Batch Does Not Have a Blank, Select One from the Database.

Note the addition of the **Sort Blanks** listbox in AlphaVision v5.6; see Section 1.4.4.3.

1.5.9. QA Control Charts: Adjustable Y-Axis Scaling

In QA mode, the **QA/Display/Custom...** function (Fig. 27) has been improved to let you either specify the **Minimum** and **Maximum** values of the **Y-axis** (which allows you to exclude outliers) or allow the software to automatically set the scale.

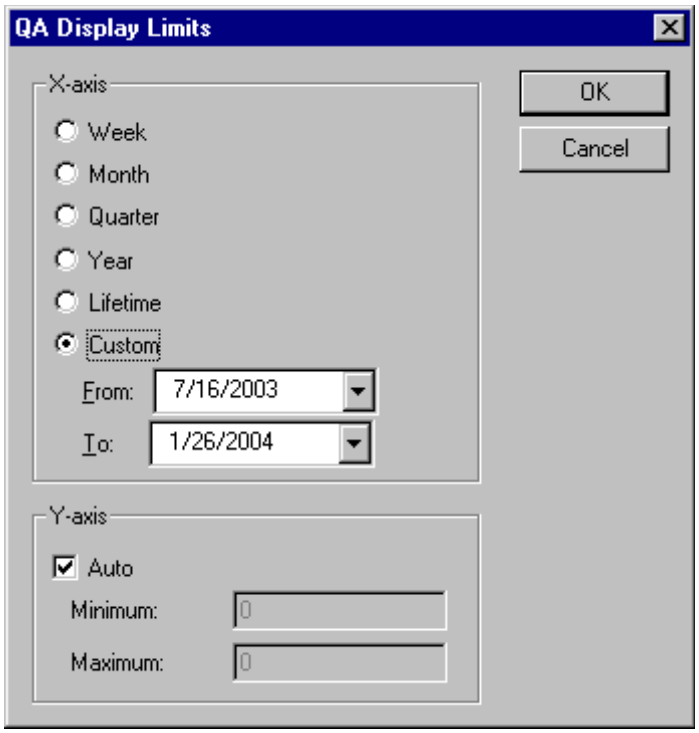


Fig. 27. Set the Control Chart Parameters for Both Axes.

2. INSTALLATION AND CONFIGURATION

This chapter discusses software and hardware installation and configuration, including how to assign the number of inputs and memory size for OCTÊTE- and 920-series multichannel buffers (MCBs), set peak positions, configure the list of MCBs available to AlphaVision v5.6, and select the correct network protocol. See also the accompanying *Installation and Release Notes* (Part No. 784550).

2.1. Installation Notes

NOTE FOR VISTA AND WINDOWS 7 USERS

Vista and Windows 7 do not support the IPX/SPX protocol. If you have ORTEC MCBs that use an Ethernet connection — e.g., OCTÊTE-E or 920E — you must connect these units to a Vista/7 PC via another interface (e.g., USB, Dual-Port Memory Interface, printer port). For assistance, contact your ORTEC representative or our Global Service Center.

- ORTEC CONNECTIONS-32 software products are designed to operate correctly for users with ***full Administrator privileges***. Limiting user privileges could cause unexpected results.

- If you are upgrading from AlphaVision Version v4.x, the installation of AlphaVision v5.6 will have no effect on existing AlphaVision v4.x files, spectra, or data. You will retain the capability to analyze **.SPC** files with AlphaVision v4.x.

- If you have an older version of MAESTRO-32 on your PC, the installation wizard might prompt you to uninstall that older version.

- If you install AlphaVision v5.6 in other than the default location, **c:\Program Files\ ORTEC\AlphaVision 5**, you must use Crystal Reports v11 to edit the paths in the report templates, **AnalysisRpt.rpt**, **BackgroundRpt.rpt**, **CalibrationRpt.rpt**, **PulserRpt.rpt**, and **QARpt.rpt**, or else AlphaVision will not be able to find and use the templates.

2.2. Step 1: Installing AlphaVision v5.6

1. Insert the AlphaVision CD-ROM, select **My Computer**, locate the CD drive, then open **Setup.exe**. In Windows 2000 and XP, this will start the AlphaVision installation wizard. In Vista and 7, a message will indicate that Windows cannot verify the publisher of this software. Select the “install anyway” option to start the installation wizard.

2. If your PC does not have Adobe Acrobat® Reader installed, the wizard will offer you an installation option. After installing/not installing Acrobat Reader, click **Next** and answer the wizard prompts.

3. On the Instrument Setup page, mark the checkbox(es) that corresponds to the instrument(s) installed on your PC, as shown in Fig. 28. If this is an AlphaVision upgrade and not a first-time installation, you probably already have ORTEC CONNECTIONS-32 instruments attached to your PC. If so, they will be included on the **Local Instrument List** at the bottom of the dialog, along with any new instruments. Existing instruments (i.e., those configured before this upgrade) do not have to be powered on during this part of the installation procedure.

   NOTE You can enable other device drivers later, as described in Section 2.6.1.

   To see more information on each instrument family, click on the family name and read the corresponding **Item Description** on the right side of the dialog.

   The **OASIS Instrument** driver is installed by default. You may leave this checkbox marked even if not using an OASIS.

   The Ethernet devices are automatically enabled, so there is no checkbox for them. If you choose the add-in driver option, an additional wizard screen will open asking which add-ins should be installed.

4. If you want other computers in a network to be able to use your MCBs, leave the **Allow other computers to use this computer's instruments** marked so the MCB Server program will be installed. Most users will leave this box marked for maximum flexibility.

   NOTE If your PC uses Windows XP and you wish to use or share ORTEC MCBs across a network, ***be sure to read Section 2.6.2*.**

5. Click on **Done**. The installation wizard will resume copying files.

6. At the end of the wizard, restart the PC. Upon restart, remove the AlphaVision CD from the drive.

7. After all processing for new alpha hardware has finished, you will be ready to configure the MCBs in your system. Connect and power on all local and network ORTEC instruments that you wish to use, as well as their associated PCs. Otherwise, the software will not detect them during installation. Any instruments not detected can be configured at a later time.

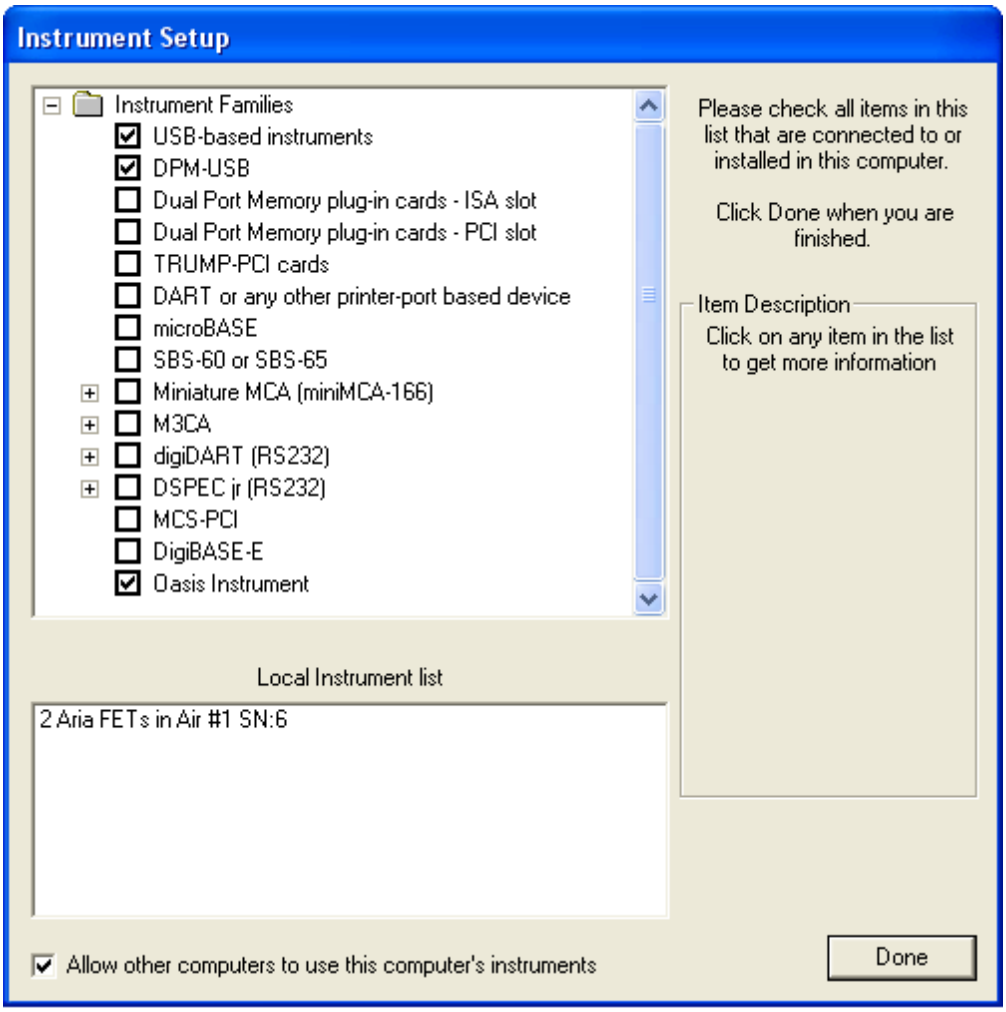

Instrument Setup
Instrument Families
USB-based instruments
DPM-USB
Dual Port Memory plug-in cards - ISA slot
Dual Port Memory plug-in cards - PCI slot
TRUMP-PCI cards
DART or any other printer-port based device
microBASE
SBS-60 or SBS-65
Miniature MCA (miniMCA-166)
M3CA
digiDART (RS232)
DSPEC jr (RS232)
MCS-PCI
DigiBASE-E
Oasis Instrument
Please check all items in this list that are connected to or installed in this computer.
Click Done when you are finished.
Item Description
Click on any item in the list to get more information
Local Instrument list
2 Aria FETs in Air #1 SN:6
Allow other computers to use this computer's instruments
Done

Fig. 28. Choose the Interface for Your Instruments.

8. ***2000 and XP users only***: For direct-connect instruments (those that communicate via Ethernet) including the OCTÊTE Plus and 920E, the network default protocol must be set to the **IPX/SPX Compatible Transport with NetBIOS** selection on all PCs that use these instruments. See Section 2.6.3 for instructions on making this the default. ***Vista and 7 do not support the IPX/SPX protocol so you must connect these units to a Vista PC via a different interface (e.g., USB, Dual-Port Memory Interface, printer port).***

9. If using ORTEC MCBs on a network, make sure the MCB Server program is running on all the PCs hosting the ORTEC instruments. (Each host PC must have MAESTRO-32, AlphaVision, or another CONNECTIONS-32 application installed.) The MCB Server icon ( ) should be displayed in the system tray on the right side of the Windows Taskbar of each host PC. If not, open Windows Explorer on that PC, go to **c:\Program Files\Common Files\ORTEC Shared\Umcbi**, and start **McbSer32.Exe**.

10. To start the MCB Configuration program on your PC, go to the Windows Start menu and select **AlphaVision 5.6**, and **MCB Configuration**. The MCB Configuration program will locate all of the (powered-on) ORTEC MCBs attached to the local PC and to (powered-on) network PCs, display the list of instruments found, allow you to enter customized instrument numbers and descriptions, and optionally write this configuration to those other network PCs; see Section 2.2.1.

2.2.1. Configuring and Customizing the Master MCB List

The initial master list of MCBs available to the ORTEC programs on your PC is determined by the MCB Configuration program, which you run as part of software installation or update, or after installing a new MCB.

When MCB Configuration runs, it searches the PC and the network (if any) for MCBs, then displays a master list of the instruments found (Fig. 29).

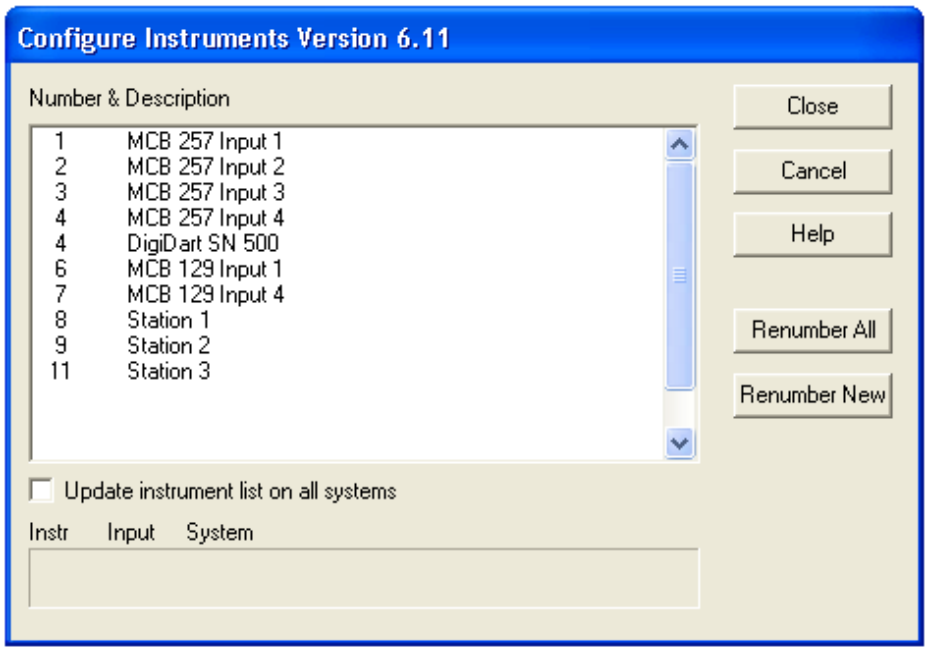


Fig. 29. MCB Numbering and Descriptions.

Some instruments have multiple inputs, so they appear on the master list as more than one instrument. For example, the OCTÊTE Plus and Model 920E have 16 inputs, so can function as 16 instruments, and can appear as 16 instruments on the master list. For the remainder of this manual, when we refer to an *instrument* or *alpha chamber* we are referring to one of the inputs in a multiple-input unit.

Note that you can change the instrument numbers and descriptions on this dialog by double-clicking on an instrument entry in the Configure Instruments dialog. This will open the Change Description or ID dialog (Fig. 30). It shows the physical detector location (read-only) and allows you to change the **ID** and **Description**. Make the desired changes and click on **Close**.

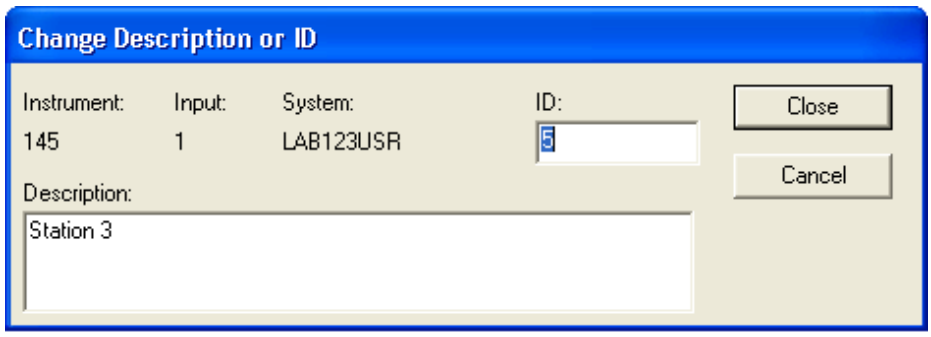


Fig. 30. Change MCB Number or Description.

If you or another user have already assigned a description to a particular instrument, you can restore the default description by deleting the entry in the **Description** field and re-running MCB Configuration. After MCB Configuration runs, the default description will be displayed.

When MCB Configuration runs, the resulting MCB configuration list is normally broadcast to all PCs on the network. If you do not want to broadcast the results, unmark the **Update detector list on all systems** checkbox under the instrument list (see Fig. 29) so the configuration will be saved only to the local PC.

The first time the system is configured, Fig. 31 will be displayed to remind you that all new instruments must be assigned a unique, *non-zero* ID number.

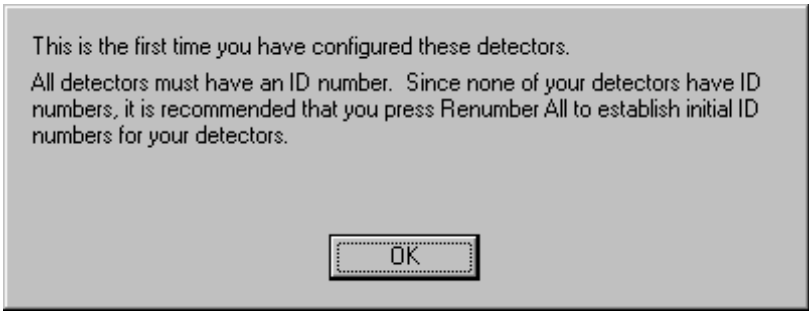

This is the first time you have configured these detectors.
All detectors must have an ID number. Since none of your detectors have ID numbers, it is recommended that you press Renumber All to establish initial ID numbers for your detectors.
OK

Fig. 31. MCB Numbering First Time.

You can change all the instrument numbers by clicking on **Renumber All** to assign new numbers in sequence; or click on **Renumber New** to renumber just the new instruments. Figure 32 will be displayed if the list is a mixture of old and new numbers.

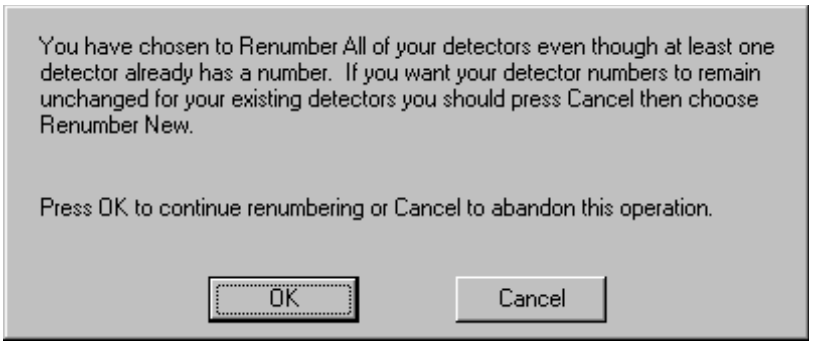

You have chosen to Renumber All of your detectors even though at least one detector already has a number. If you want your detector numbers to remain unchanged for your existing detectors you should press Cancel then choose Renumber New.
Press OK to continue renumbering or Cancel to abandon this operation.
OK
Cancel

Fig. 32. Renumbering Warning.

NOTE Remember that some applications use the instrument number to refer to a specific MCB or device (e.g., the **.JOB** file command SET_DETECTOR 5). Therefore, you might want to subsequently avoid changing its ***number*** so all defined processes will still operate.

When you have completed all changes to the instrument list, click on **Close** to close the Configure Instruments dialog. At this point, GammaVision and other CONNECTIONS applications can be run on any PC, and the MCB pick list for each program on each PC can be tailored to a specific list of instruments.

2.3. Step 2: Configuring OCTÊTEs and 920s with SET920

If you are ***not*** setting up OCTÊTE- or 920-series MCBs for the first time, skip to Section 2.4.

The number of inputs (1–16) and memory size (number of channels) for each detector input in OCTÊTE- and 920-series MCBs is computer controlled by the **SET920** program, supplied on diskette with your hardware. Normally you will only run it when you add a new MCB to the system, and will not use it again except to change the number of inputs or the total memory size. If you have already set up the number of inputs and memory size for each detector in your OCTÊTE- and/or 920-series MCBs, skip to Section 2.4.

1. To run SET920, go to the Windows Start menu and select **AlphaVision 5.6** and **SET920**.

   Figure 33 shows the opening SET920 dialog. Click on the MCB droplist and select the input to be changed (SET920 displays only the instrument types listed above). The second field shows the current memory size and number of inputs.

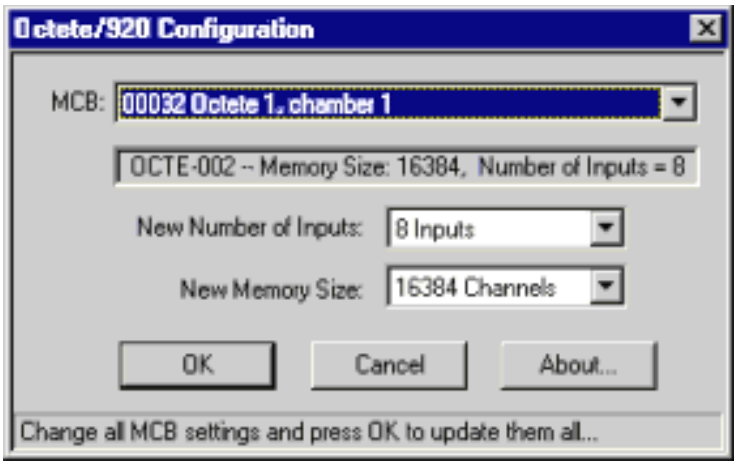


Fig. 33. The SET920 Configuration Dialog.

The **New Number of Inputs** is the number of detectors to be used by this OCTÊTE. For example, the OCTÊTE Plus can have 1, 2, 4, 8 or 16 detectors. The normal selection, however, will be either 8 (all internal) or 16 (8 internal and 8 external).

The **New Memory Size** is the total number of channels available for all of the inputs. The individual number of channels is *Memory Size / Number of Inputs*. For example, in an OCTÊTE Plus, a setting of 16 inputs and 8K memory will allot 512 channels for each input spectrum. This can be equal to, greater than, or less than the ADC conversion gain for each detector.

The ADC conversion gain and offset can be set for each MCB in AlphaVision (right-click on the detector of interest, select **Detector Properties...**, then click on the **Chamber Properties...** button), or MAESTRO (**Acquire/MCB Properties...**).

3. When finished editing all the MCBs, click on **OK** to exit the program. The changes will be stored in the MCBs at this point, however, you must run the Instrument Configuration program again before AlphaVision can detect and use the changes. If you have made any changes, SET920 will ask if you want to automatically run the Instrument Configuration program. Click on **Yes**, allow the search to proceed, review the resulting list, then click on **Close**. For additional instructions on the Instrument Configuration program, see the AlphaVision HTML User Manual under **Help/Contents**.

2.4. Step 3: Setting Peak Positions

1. Start MAESTRO.

2. Determine the correct gain for the energy range and MCB channels selected. For example, using 3–8 MeV and 512 channels, the energy gain is 9.765 keV/channel (5000 keV/512 channels) and the offset is 3000 keV. Using 2–10 MeV and 1024 channels, the energy gain is 7.8125 keV/channel and the offset is 2000 keV.

3. Determine the target locations for the primary alpha emission energies of the calibration standard as *[Target Channel = (Primary Emission Energy Offset)/Gain]*. For example, using a mixed Pu/U calibration standard, with a ^{238}Pu primary energy of 5499 keV and a ^{238}U primary energy of 4196 keV, 3000 keV offset, and 9.765 keV/channel gain, the target channel for ^{238}Pu is *[(5499 - 3000)/9.765]* or channel 256. Similarly, the target channel for ^{238}U would be *[(4196 - 3000)/9.765]* or channel 122.

4. Clear the detector (**Acquire/Clear**), enable the bias voltage (**Acquire/MCB Properties...**, High Voltage tab; or manually), and start data acquisition (**Acquire/Start**). Using the observed peak position and the target channels determined above, adjust the energy gain (**E CAL**) for the detector to locate the peaks in the proper channels. This is an iterative process for each detector.

5. Once the gain is set, stop acquisition (**Acquire/Stop**), clear the detector (**Acquire/Clear**).

6. Repeat this process for each detector. Exit MAESTRO.

2.5. Step 4: Reserving a “Clean Copy” of the Database

We recommend that, before using AlphaVision v5.6 for the first time, you make an archive copy of the empty **AlphaVision.mdb** database file. You can then use it, in conjunction with the Database Management utilities (Section 4.3), to create new AlphaVision databases.

2.6. Additional System Configuration Operations

2.6.1. Enabling Additional ORTEC Device Drivers and Adding New MCBs

You can enable other device drivers later with the Windows **Add/Remove Programs** utility on the Control Panel. Select **Connections 32** from the program list, choose **Add/Remove**, then elect to **Modify** the software setup. This will reopen the Instrument Setup dialog so you can mark or unmark the driver checkboxes as needed and close the dialog.

When an MCB is added to the system, or if you change total memory size and number of segments for a multi-input MCB such as the Model 920 or OCTÊTE-series instruments, you cannot communicate with the new input(s) until you add it to the Master Instrument List by re-running the MCB Configuration program, as described in Step 9 on page 28.

2.6.2. If You Wish to Share Your Local ORTEC MCBs Across a Network

NOTE If you do not have instruments connected directly to your PC or do not wish to share your instruments, this section does not apply to you.

If your PC is running under Windows XP Service Pack 2 or higher, Vista Ultimate, or Windows 7, the default firewall settings will prevent other computers from accessing the CONNECTIONS-32 MCBs connected directly to your PC. To share your locally connected ORTEC instruments across a network, you must enable **File and Printer Sharing** on the Windows Firewall Exceptions list. To do this:

1. From the Windows Control Panel, go to the **Security** feature for your operating system and access the **Windows Firewall** entry. Figure 34 illustrates how to access the **Change Windows Firewall Settings** task from the **Network Connections** control panel option. This will open the Windows Firewall dialog.

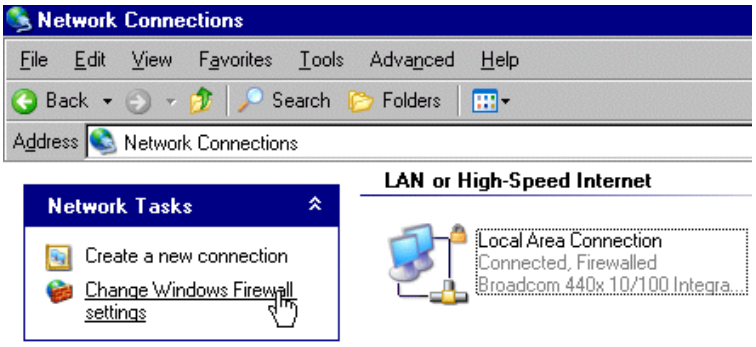


Fig. 34. Change the Firewall Settings.

2. Go to the Exceptions tab, then click to mark the **File and Printer Sharing** checkbox (Fig. 35).

   NOTE This affects only the ability of other users on your network to access your MCBs. You are *not required* to turn on **File and Printer Sharing** in order to access networked MCBs (as long as those PCs are configured to grant remote access).

3. To learn more about exceptions to the Windows Firewall, click on the **What are the risks of allowing exceptions** link at the bottom of the dialog.

4. Click on **OK** to close the dialog. No restart is required.

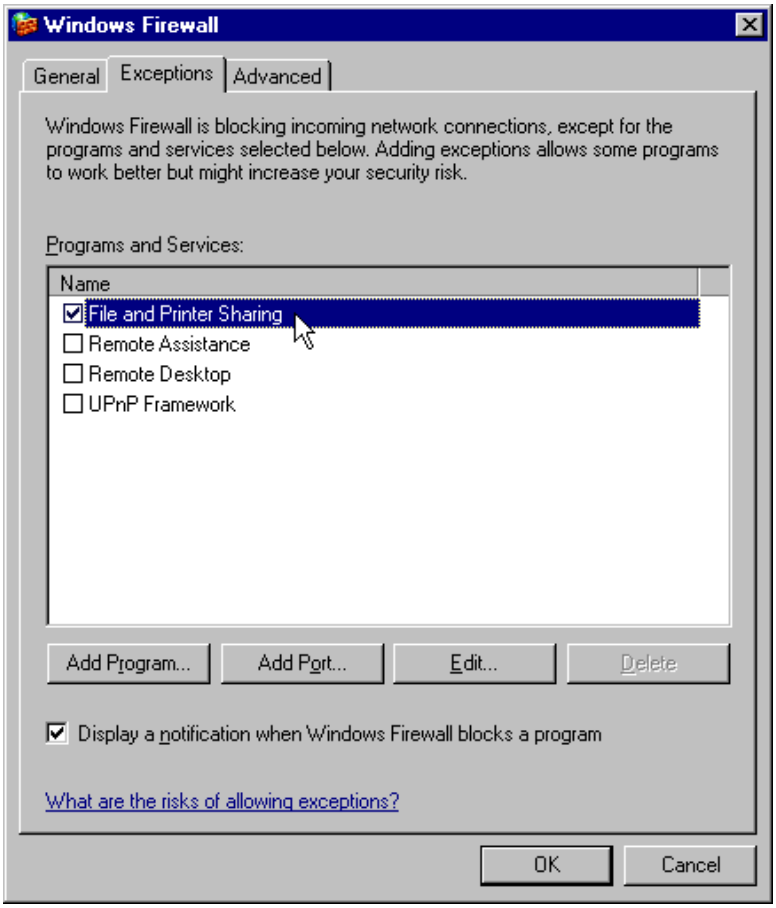


Fig. 35. Turn on File and Printer Sharing.

2.6.3. Setting Up the IPX/SPX Network Protocol (2000 and XP Users Only)

ORTEC CONNECTIONS-32 uses all of the network "languages" — called *protocols* — supported by Windows 2000 Professional and XP Professional SP2, *but Vista and 7 do not support IPX/SPX*. This section describes how to select the right Windows protocols for CONNECTIONS-32 operation. If multiple protocols are installed on the various PCs in the network, only those PCs with compatible protocols will be able to communicate with one another. No special settings are required in that case.

CONNECTIONS-32 products with built-in Ethernet adapters, such as the OCTÊTE Plus and 920E, communicate directly with the PCs on the network. The PCs and these units must "speak the same language" (i.e., use the same protocol) in order to understand each other.

2.6.3.1. Windows 2000 Setup

There is only one setting needed on Windows 2000. To access this setup, select **Settings/ Network and Dial-up Connection** as shown in Fig. 36. This will display the existing connections as shown in Fig. 37. If no network hard-ware is shown, install the hardware and follow the instructions for new hardware.

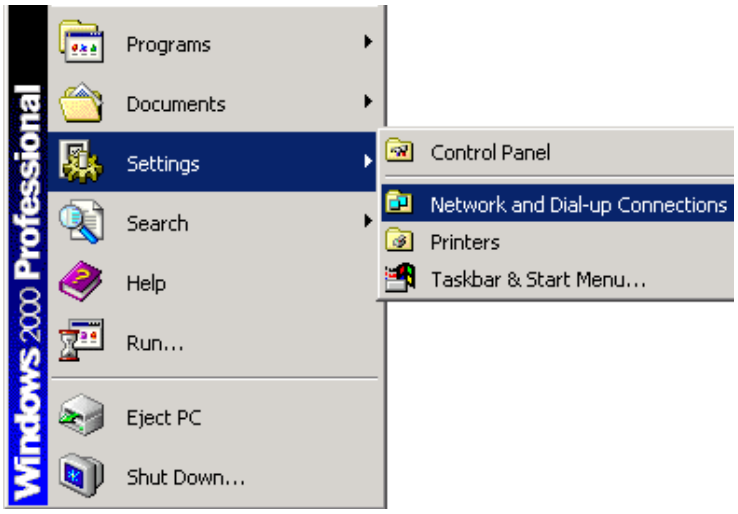


Fig. 36. Start Network and Dial-up Connection..

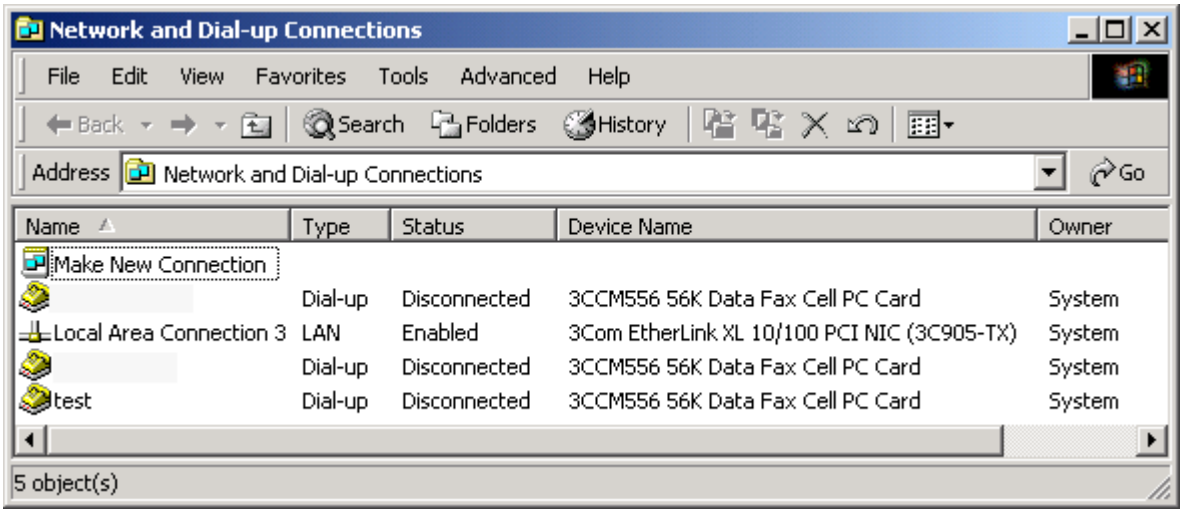

Network and Dial-up Connections
File Edit View Favorites Tools Advanced Help
Back Search Folders History
Address Network and Dial-up Connections
Go
Name Type Status Device Name Owner
Make New Connection
Dial-up Disconnected 3CCM556 56K Data Fax Cell PC Card System
Local Area Connection 3 LAN Enabled 3Com EtherLink XL 10/100 PCI NIC (3C905-TX) System
Dial-up Disconnected 3CCM556 56K Data Fax Cell PC Card System
test Dial-up Disconnected 3CCM556 56K Data Fax Cell PC Card System
5 object(s)

Fig. 37. Network and Dial-up Connections.

Select the **LAN** connection and double click on it to display the status dialog as shown in Fig.38. Select **Properties** to display Fig. 39.

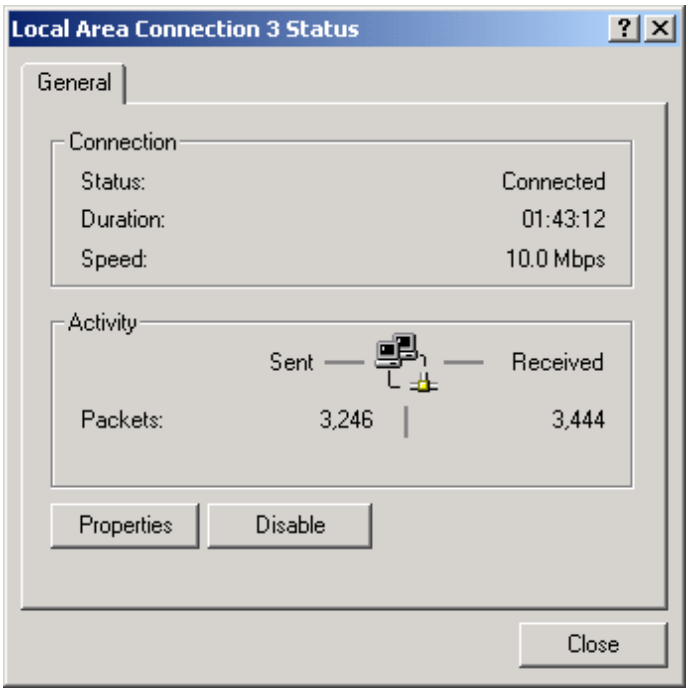


Fig. 38. LAN Connection.

Select the **NWLINK IPX...** as shown and then **Properties** to display Fig. 40.

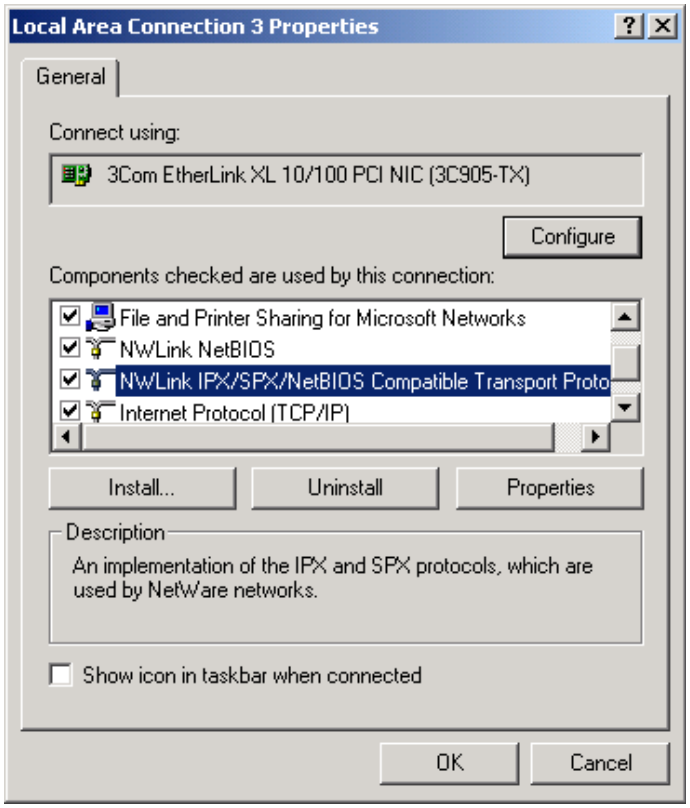


Fig. 39. LAN Properties.

Now select the **Frame type** to 802.3 as shown.

Click on **OK** and return to the Desktop.

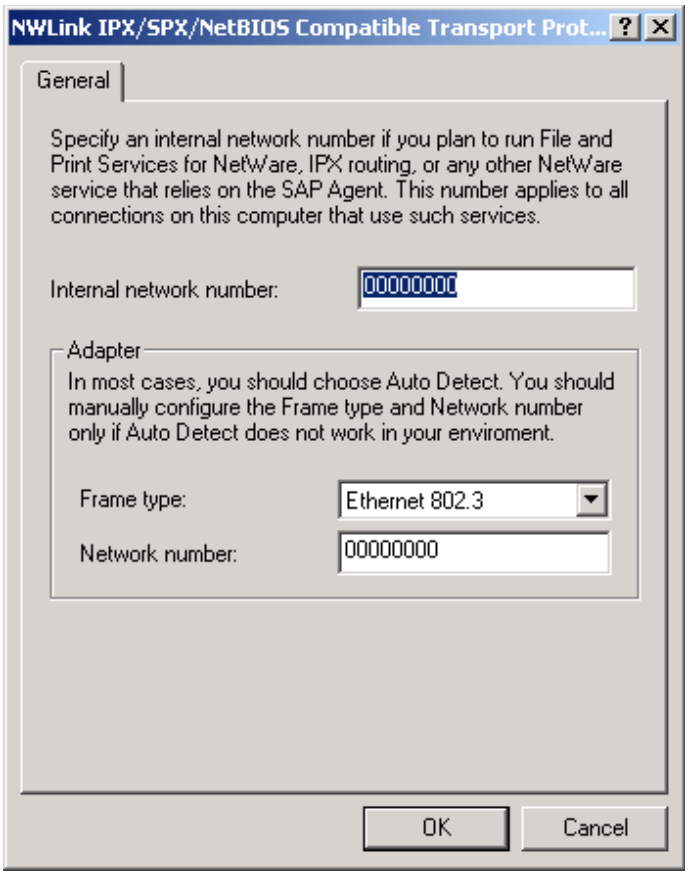

NWLink IPX/SPX/NetBIOS Compatible Transport Prot...
General
Specify an internal network number if you plan to run File and Print Services for NetWare, IPX routing, or any other NetWare service that relies on the SAP Agent. This number applies to all connections on this computer that use such services.
Internal network number:
00000000
Adapter
In most cases, you should choose Auto Detect. You should manually configure the Frame type and Network number only if Auto Detect does not work in your enviroment.
Frame type:
Ethernet 802.3
Network number:
00000000
OK
Cancel

Fig. 40. NWLINK IPX... Protocols.

2.6.3.2. Windows XP Setup

To determine whether the NWLink IPX/SPX/NetBIOS Compatible Transport Protocol is installed, to add it, or to select it as the default, go to the Taskbar and click on **Start**, then **Control Panel**. In the Control Panel under "Pick a Category," choose **Network and Internet Connections** (Fig. 41).

Fig. 41. Opening the Control Panel, then Network and Internet Connections.

Under "Pick a Control Panel Icon," click on **Network Connections** (Fig. 42). This will display the **LAN or High-Speed Internet** connections, as shown in Fig. 43.

Fig. 42. Network Connections.

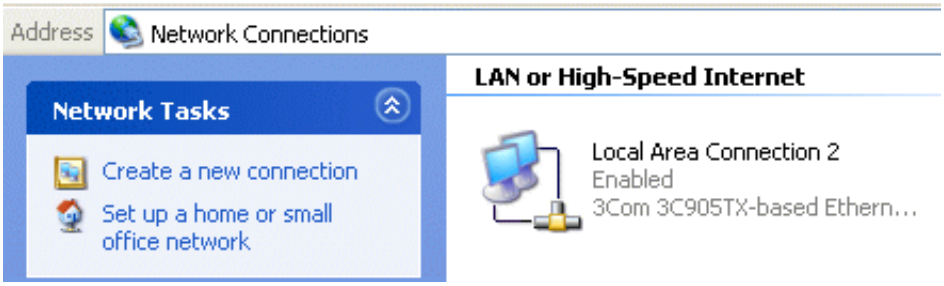


Fig. 43. Existing Network Connections.

If no network entry is shown, install the hardware and follow the instructions for new hardware, then return to this screen.

Double-click on the existing LAN entry to display the status dialog shown in Fig. 44. Click on **Properties** to open the LAN properties dialog (Fig. 45).

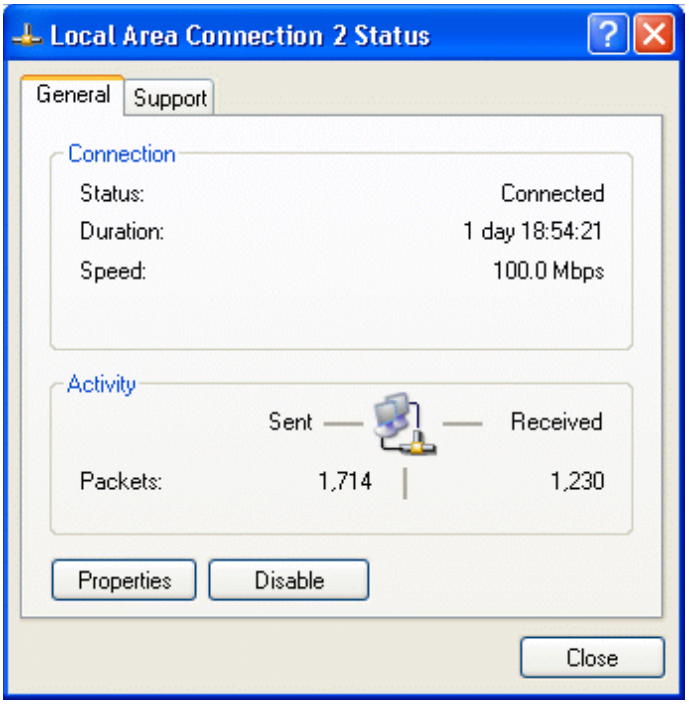


Fig. 44. LAN Connection Status.

To add the **NWLink IPX/SPX/NetBIOS Compatible Transport Protocol**, click on the **Install...** button. This will open the Select Network Component Type dialog (Fig. 46).

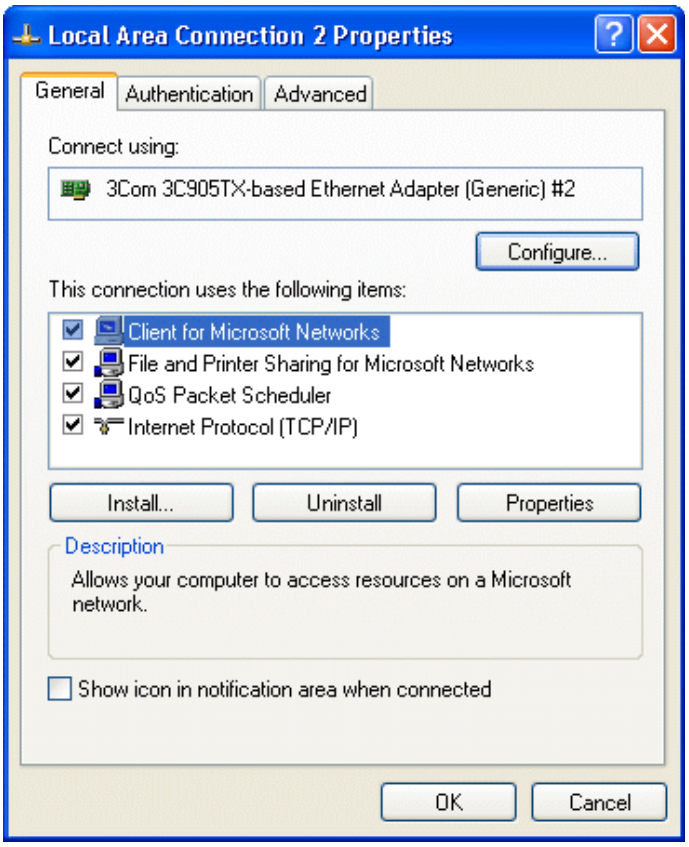


Fig. 45. LAN Properties.

Click on **Protocol** to display the Select Network Protocol dialog shown in Fig. 47.

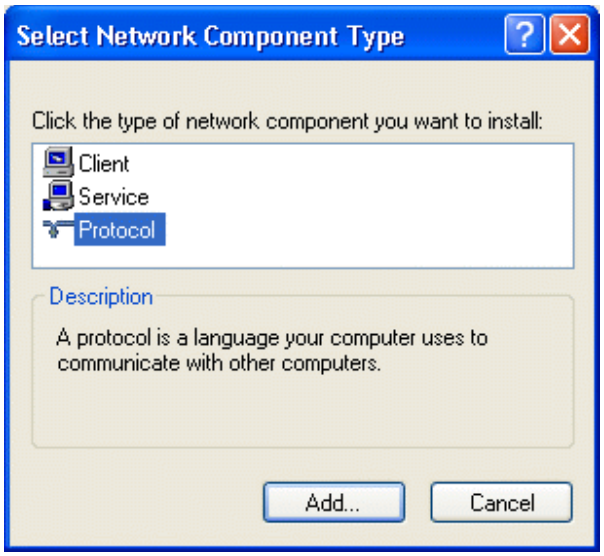


Fig. 46. Add a New Protocol.

Click on **NWLink IPX/SPX/ NetBIOS Compatible Transport Protocol**, then click on **OK** to return to the Local Area Connection Properties dialog (Fig. 48).

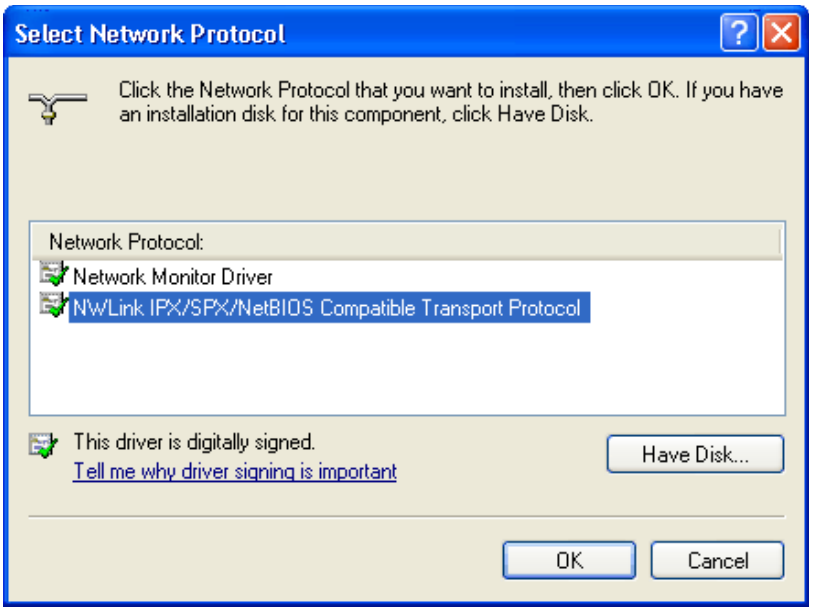

Select Network Protocol
Click the Network Protocol that you want to install, then click OK. If you have an installation disk for this component, click Have Disk.
Network Protocol:
Network Monitor Driver
NWLink IPX/SPX/NetBIOS Compatible Transport Protocol
This driver is digitally signed.
Tell me why driver signing is important
Have Disk...
OK
Cancel

Fig. 47. Choose the Correct Protocol.

Select **NWLINK IPX...** as shown, then click on **Properties** to open the dialog shown in Fig. 49.

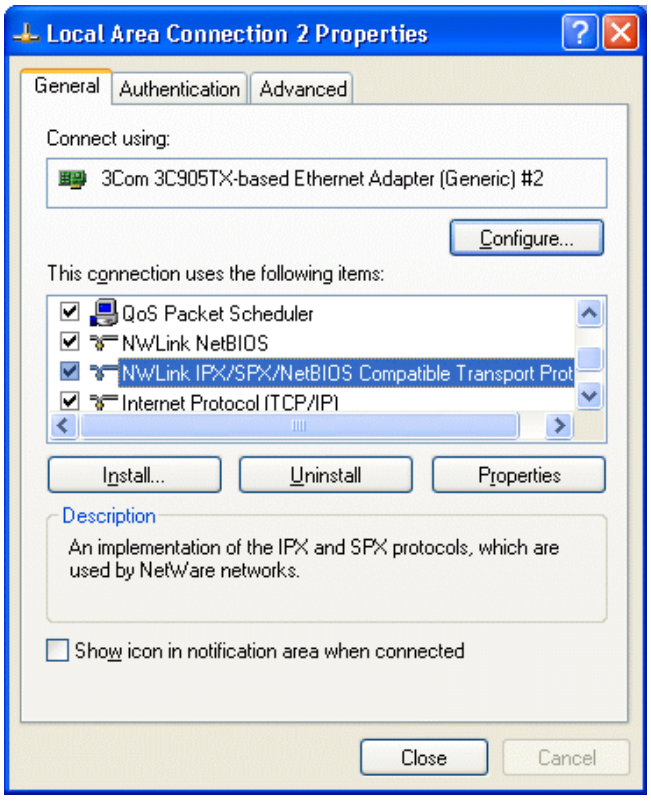


Fig. 48. LAN Properties.

Set the **Frame type** to 802.3 as shown, then click on **OK**, **Close**, and **Close** to return to the Windows desktop.

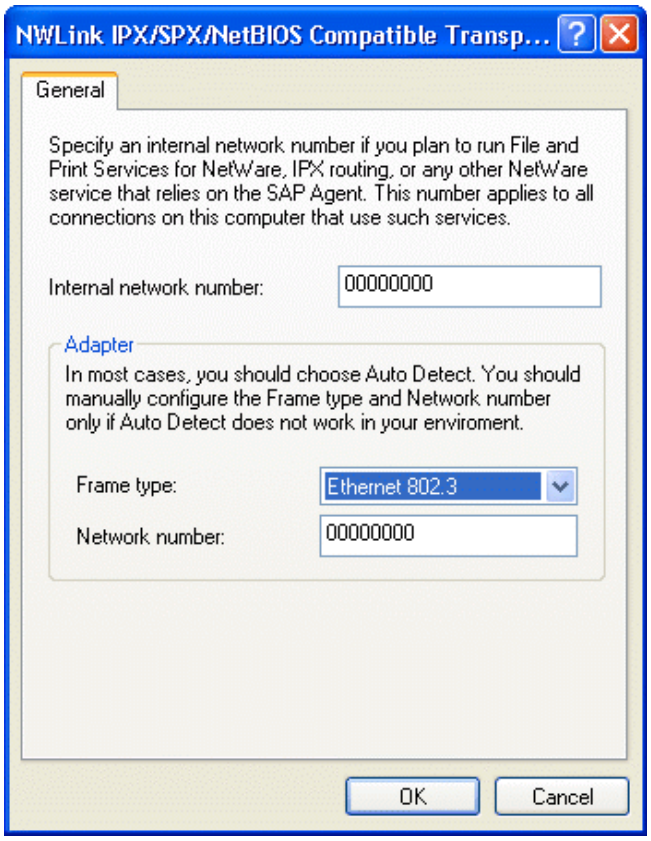

NWLink IPX/SPX/NetBIOS Compatible Transp...
General
Specify an internal network number if you plan to run File and Print Services for NetWare, IPX routing, or any other NetWare service that relies on the SAP Agent. This number applies to all connections on this computer that use such services.
Internal network number:
00000000
Adapter
In most cases, you should choose Auto Detect. You should manually configure the Frame type and Network number only if Auto Detect does not work in your enviroment.
Frame type:
Ethernet 802.3
Network number:
00000000
OK
Cancel

Fig. 49. Choose the Correct Frame Type.

3. USING THE ALPHAVISION 5.x USER INTERFACE

This chapter presents an overview of the new AlphaVision v5.6 user interface. For more in-depth discussion of the screen features, refer to the HTML Help Manual.

3.1. Startup and Login

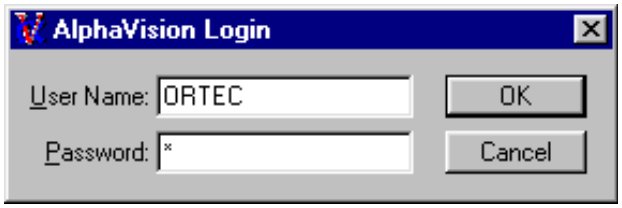


Fig. 50. Log In.

To start AlphaVision, go to the Windows Taskbar and click on **Start**, **Programs**, **AlphaVision 5.6**, **AlphaVision 5.6**. The login dialog will open (Fig. 50). The default **User Name** from the factory is **ORTEC** (all uppercase; note that AlphaVision usernames and passwords are case sensitive). The default password associated with **ORTEC** for login is **o** (lowercase letter **o**, not zero).

The default username and password are assigned to the **Administrator** security level, giving you access to all AlphaVision v5.6 commands and operations. After initial login you can choose to define additional security levels (**Edit/Security Levels...**) and set up new usernames and passwords (**Edit/Users...**), or simply continue using the default login.

3.2. The User Interface

The AlphaVision v5.6 user interface is designed so all sample, reporting, hardware, and QA management is accessible from the main AlphaVision screen with a few mouse clicks. The screen is divided into 3 main functional areas:

1. **Outlook Toolbar** — The Outlook Toolbar contains icons for each of the 4 modules (**Calibration**, **Batch**, **Hardware**, and **QA/QC**).

2. **Detector Grid** — At the bottom of the screen, the Detector Grid displays the detectors that are currently configured for your system. The rows and columns have spreadsheet-style headers to help you quickly locate a particular instrument. From the grid you can add, remove, and organize MCBs and detectors; pause or stop data acquisition; clear detector memory; adjust grid and system properties; and start MAESTRO-32 (if you choose to install it). See the tutorial in Chapter 5 for instructions on adding detectors to the Detector Grid. Pausing the mouse over a detector icon in the grid opens a *hover box* that shows the alpha chamber and detector names, real and live times, and, when the detector is counting, the batch and sample names.

3. **Explorer Panel** — The remainder of the screen is the Explorer Panel. This is the gateway to all of the data analyses in your AlphaVision v5.6 database.

   - In **Calibration** and **Batch** modes, this panel is divided into 2 parts: The lower section, the Spectrum/Report Window, enables you to view either the spectrum or report for a given analysis. The upper section is, respectively, the Calibration Explorer Panel or Batch Explorer Panel.

     — The Calibration Explorer allows you to display the calibration history for each detector in the system, and the Calibration Reports associated with each calibration spectrum and analysis. To see this calibration history, click on one of the detectors in the Detector Grid. The most recent calibration (i.e., the calibration now being used by this detector) will be displayed in the Spectrum Window. Note that if you have not yet calibrated the detector, no data will displayed for it.

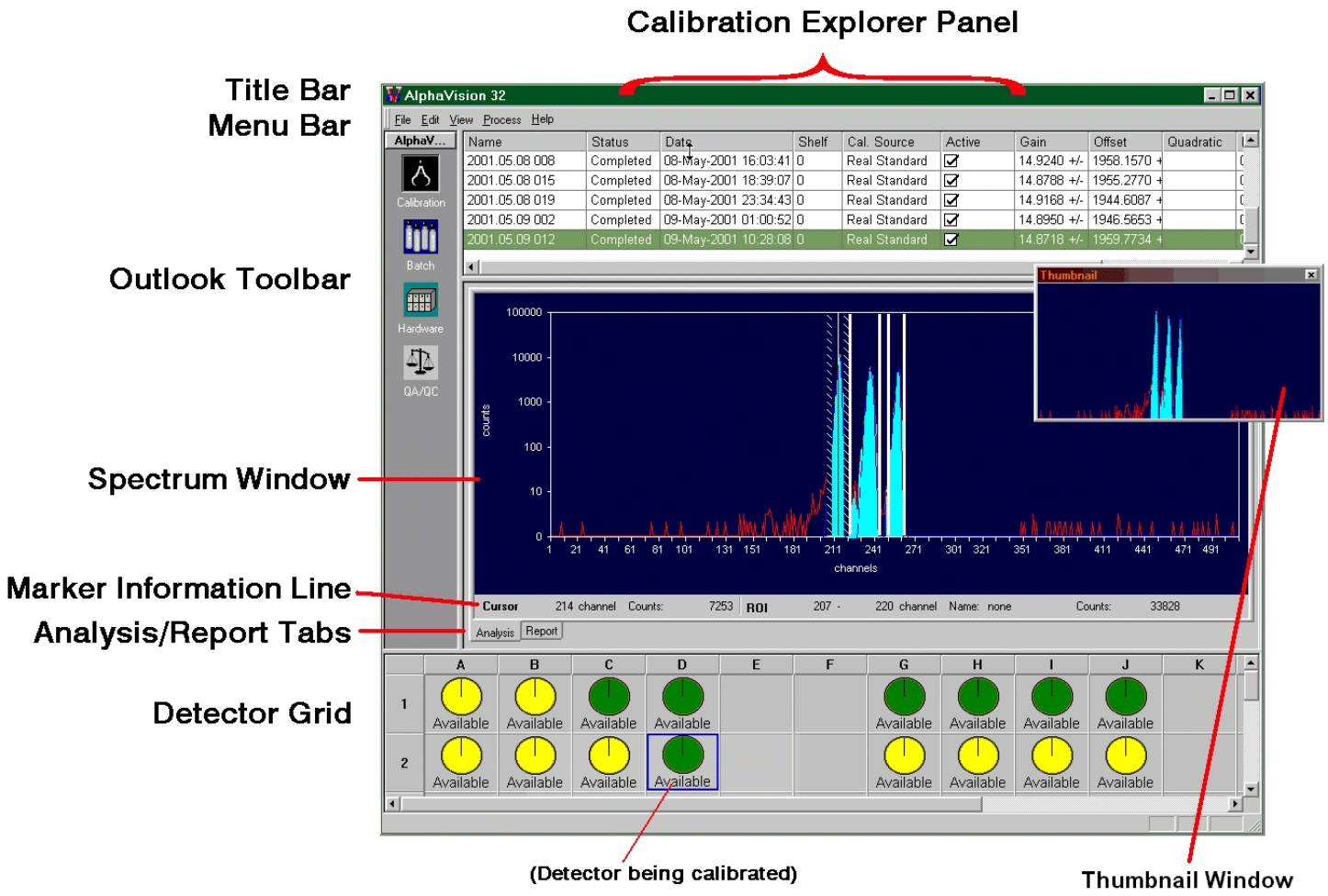
     — The Batch Explorer allows you to locate and view the records and reports for your Batch, Background, and Pulser Test batches, samples, spectra, and analyses.

   - In **QA/QC** mode, the Limits tab allows you to set up and monitor the QA control limits and Control Charts. The Charts and Report tabs at the bottom of the panel let you generate, view, and print the Control Charts and QA Reports.

   - The **Hardware** Panel allows you to set up and monitor *only* the alpha chambers of ORTEC Aria, Duo, Ensemble, and OCTÊTE-series instruments; and the Oxford OASIS. To set up and monitor other instruments, *you must use MAESTRO*.

The commands on the **File**, **Edit**, **View**, and **Help** menus remain the same in all modules. In addition, each module except **Hardware** has its own menu(s) containing unique commands. The Outlook Bar and Detector Grid remain the same from module to module.

Figures 51 through 54 show annotated illustrations of the **Calibration**, **Batch**, **Hardware**, and **QA/QC** interfaces and menus, respectively.



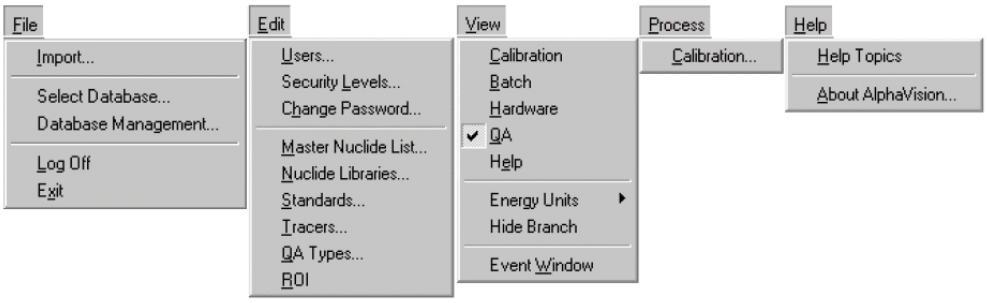


Fig. 51. Calibration Mode Screen Features and Menus.

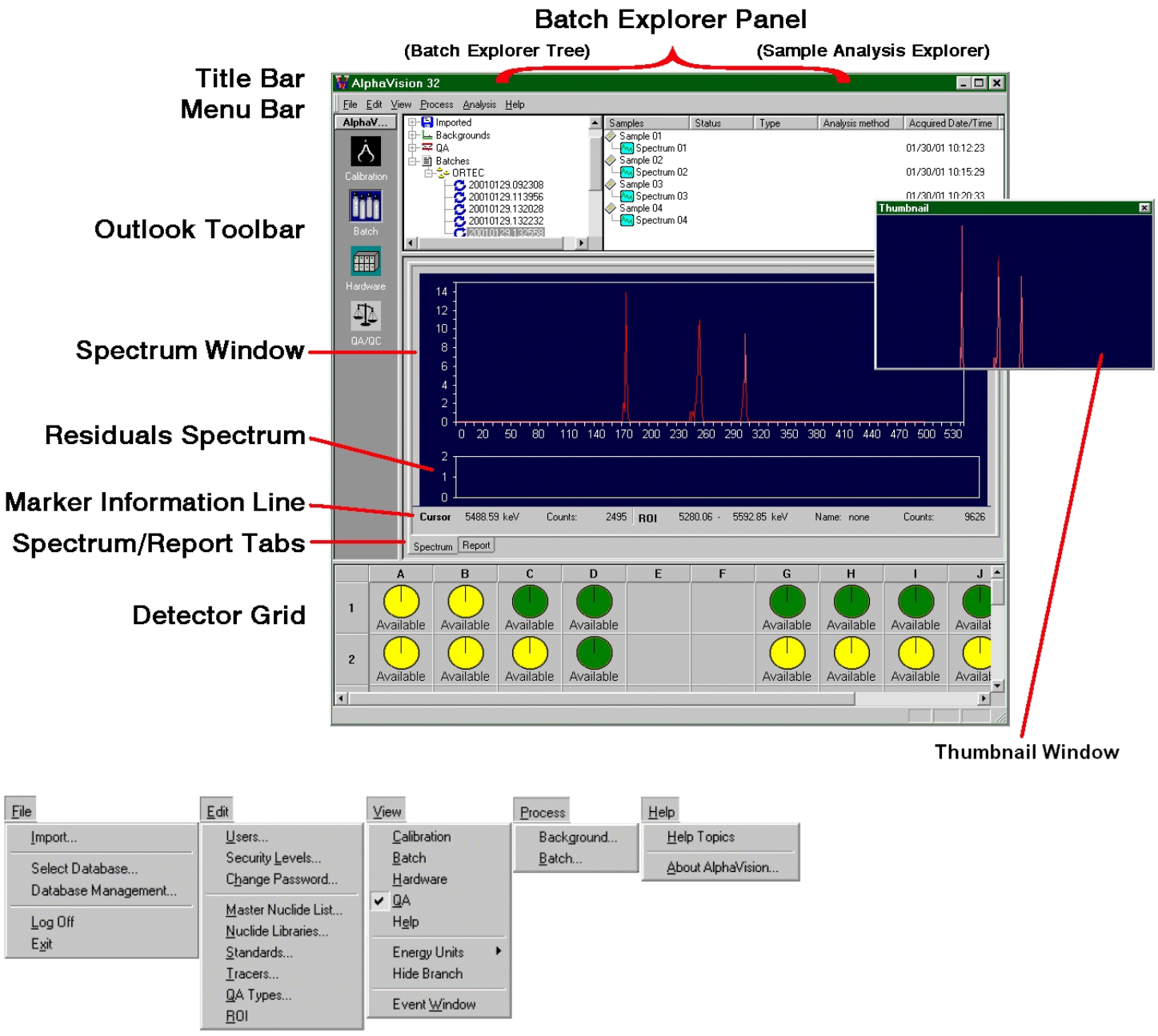
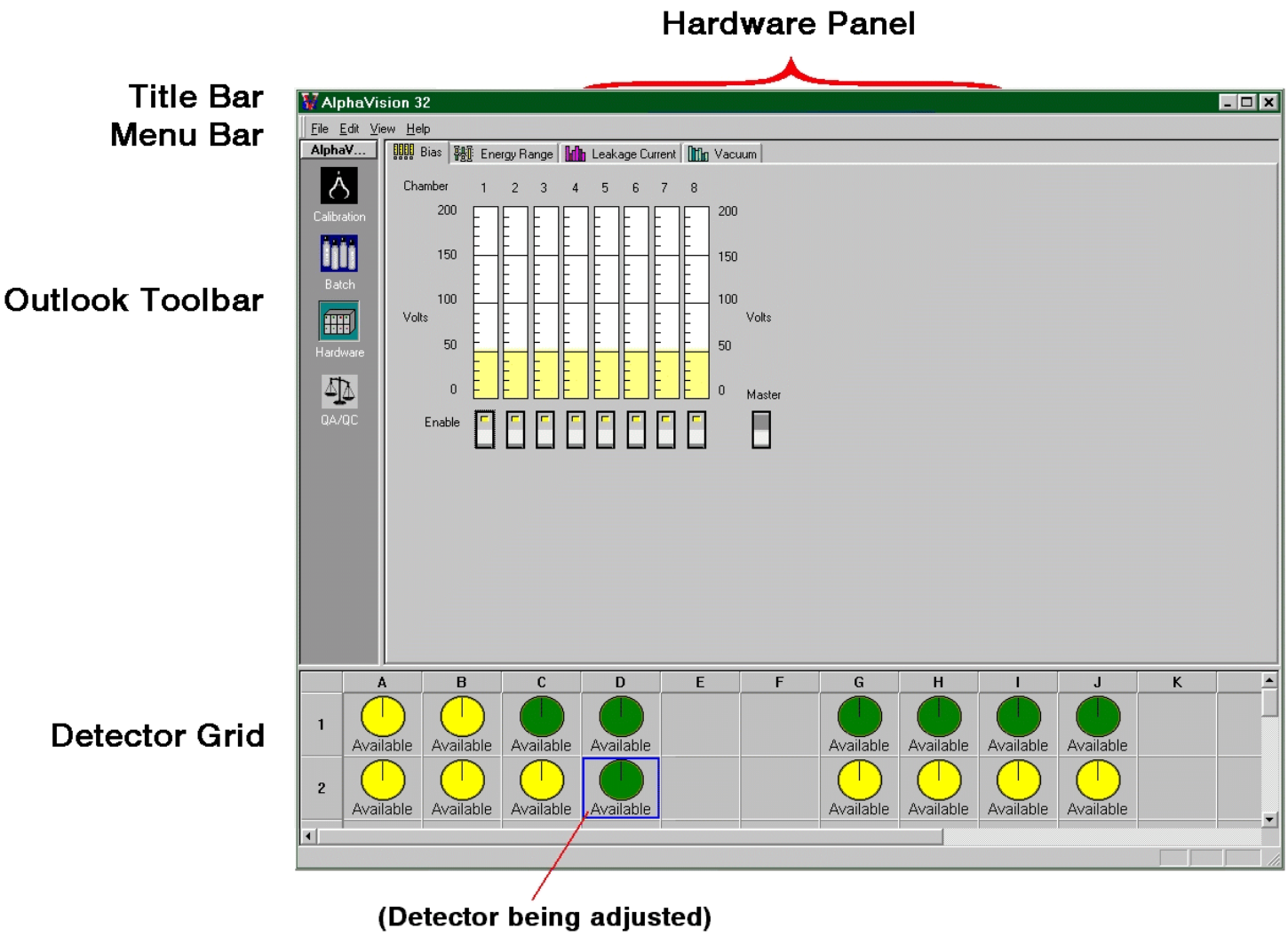


Fig. 52. Batch Mode Screen Features and Menus.



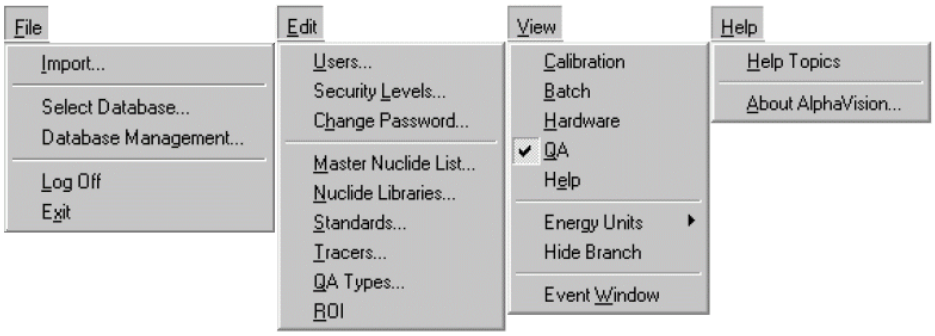


Fig. 53. Hardware Mode User Interface and Menus.

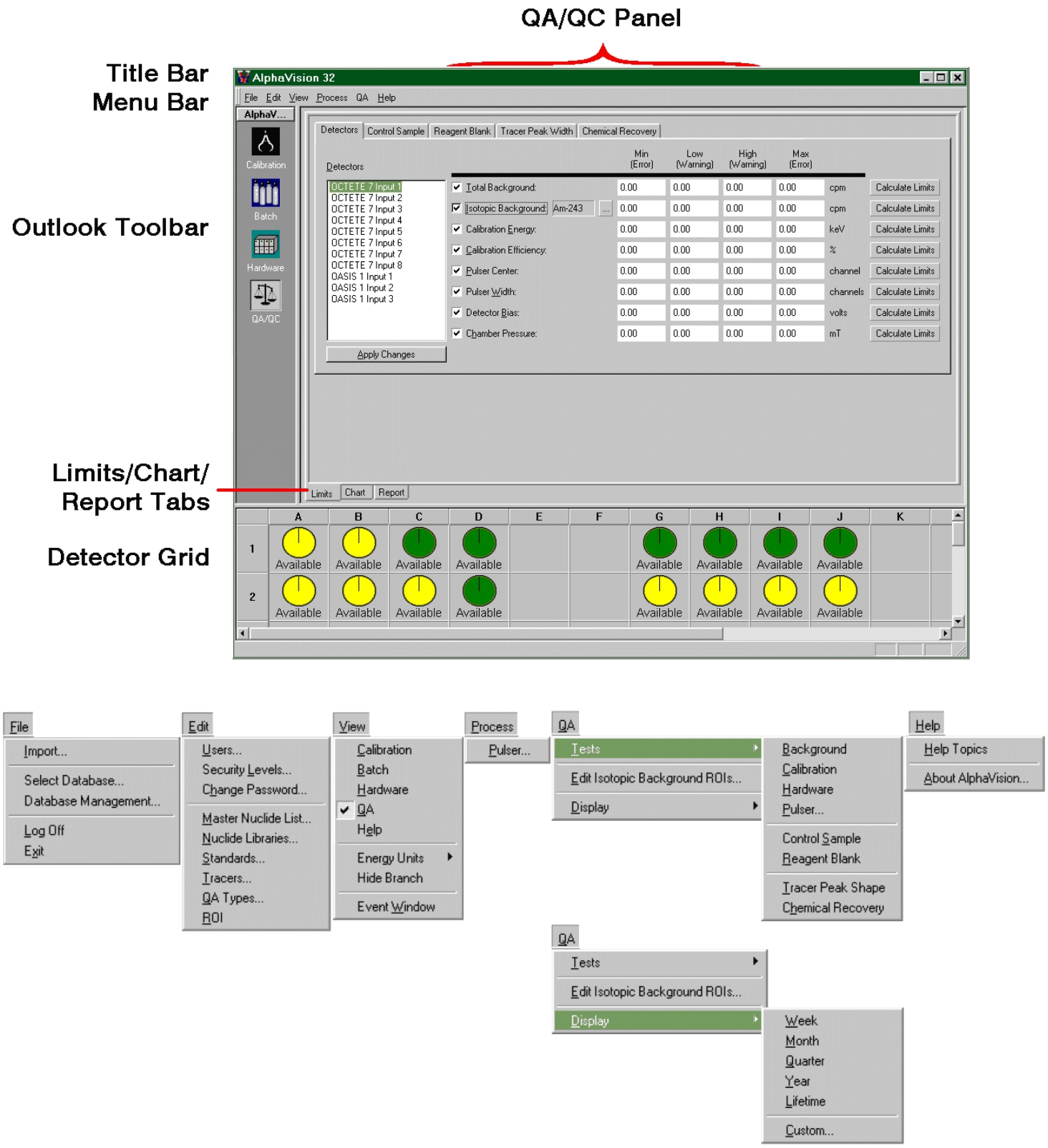


Fig. 54. QA/QC Mode Screen Features and Menus.

3.2.1. The Calibration Explorer Panel

The Calibration Explorer Panel (Fig. 55) is ***your tool for viewing and evaluating the results of detector calibrations in the AlphaVision database***. This panel lists the calibration history for the selected detector (click on its Detector Grid icon). Note that if the detector is not yet calibrated, no records for it will be displayed in the Calibration Explorer. Calibration records include data such as the record **Name**, acquisition **Date**, **Calibration ID**, **Gain**, **Offset**, and **Efficiency**.

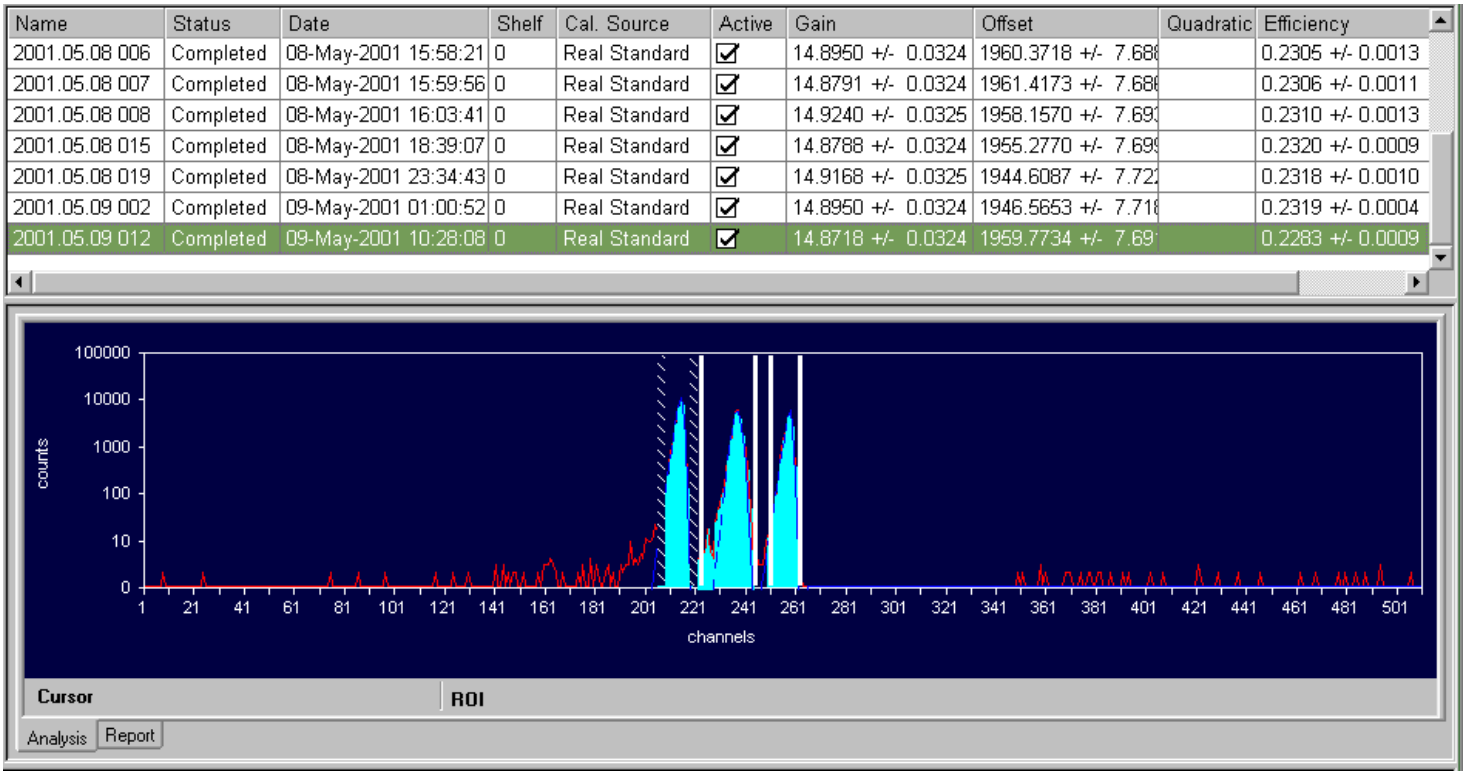


Fig. 55. The Calibration Explorer Panel.

The Calibration Explorer also allows you to **Update** a calibration, that is, to reanalyze the calibration spectrum. You can also permanently remove the results from the calibration history. These features enable you to correct errors such as entering an incorrect calibration source for the calibration. The **Update** command allows you to change the calibration parameters and create an updated calibration from the resulting analysis. Note that updating a calibration adds a data point to the corresponding QC Chart to ensure that QC data integrity is preserved.

The Calibration Explorer tells at a glance which calibrations match the selected detector's current geometry/alpha-chamber shelf position; which calibrations have been analyzed and completed vs. those still being acquired and analyzed; and which is the detector's current active/working calibration. In addition, you can start acquisition for a calibration that has been set up but not yet counted, remove calibrations that are no longer needed, and update a calibration setup to correct data entry errors.

3.2.2. Accessing Batch, Background, and QA Data in the Batch Explorer Panel

The Batch Explorer Panel (Fig. 56) is your ***primary organizational tool for and portal to the sample information in your AlphaVision database***. It is also your point of access to data imported from earlier versions of AlphaVision, instrument background records, and QA pulser test spectra.

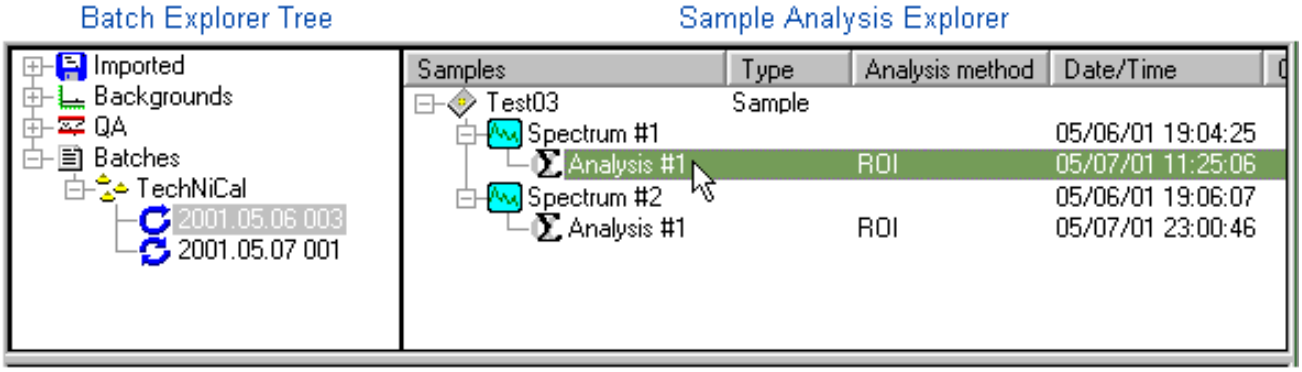


Fig. 56. The Batch Explorer Panel's Components, the Batch Explorer Tree and Sample Analysis Explorer.

The Batch Explorer Panel is an intuitive, visual representation of all your batch, background, and QA data, organized hierarchically in levels and sublevels that you define. (Calibration data are displayed separately in the Calibration Explorer Panel.) Your ability to modify the database from this panel is limited; for instance, you can't click, drag, copy, cut, paste, rename, or delete records from it. For these kinds of operations, see the suite of database management tools (Section 3.2.2). However, the Batch Explorer Panel provides tools for revising sample information created in the Batch Wizard, counting batches or samples that have not been counted yet, recounting batches or samples, analyzing existing spectra, and updating (i.e., overwriting) existing analyses.

The tutorial and the HTML Help Manual give detailed instructions on adding new organizational "branches" to the Batch Explorer Tree; locating analysis records; changing acquisition presets; modifying sample properties; and counting, analyzing, and reanalyzing from the Batch Explorer.

3.2.2.1. Hiding or Displaying Branches in the Batch Tree

It doesn't take long to fill the Batch Tree with the entries for completed projects. To keep your Batch Tree uncluttered and easy to read, AlphaVision v5.6 lets you hide or display one or more of the branches in the tree. This is a 2-step process in which you flag all of the branches you wish to hide, then hide them all with a single command.

To flag a branch for hiding, right-click on it and select **Hide Branch**. To then hide the flagged branches, go to the **View** menu and click on **Hide Branch**. All flagged branches will be removed from view, and a checkmark will be displayed beside the command on the **View** menu. To redisplay the flagged branches, just issue the **View/Hide Branch** command again (this will also remove the checkmark from beside the command on the menu). To unflag a branch so that it is no longer affected by the hide command, right-click on it and select **Un-Hide Branch**. You can flag/unflag and hide/display as many branches as you wish, and at any time.

The next three figures illustrate this process. Figure 57 shows the *January* branch being flagged for hiding. In Fig. 58, the **View/Hide Branch** command is issued, and Fig. 59 displays the result — the *January* branch is no longer visible in the Batch Tree, although its entry is still fully retained in the database and accessible by unhiding it.

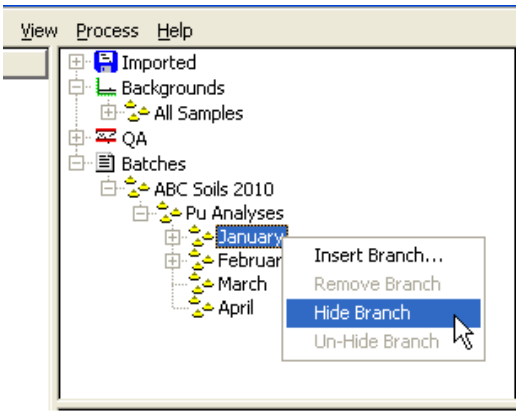


Fig. 57.

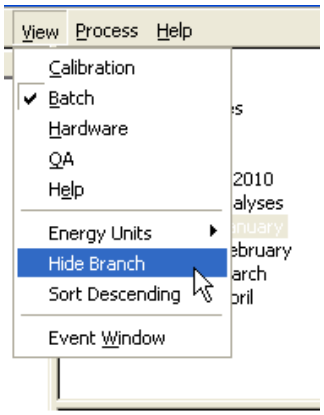


Fig. 58.

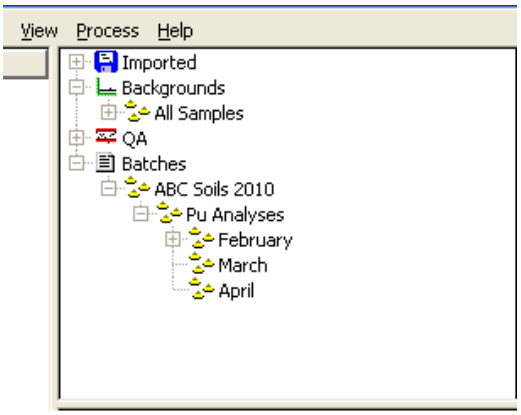


Fig. 59.

Another way to simplify your Batch Tree is to create a new database for each project with the **File/Database Management...** tools (see Section 3.2.2).

3.2.3. The QA/QC Panel

The QA/QC Panel (Fig. 60) is your access to the QA control limits, Control Charts, and QA Reports. Background and Pulser QA spectra, analyses, and analysis reports are available through the Batch Explorer Panel.

The QA window has 3 views governed by the tabs at the bottom of the panel (click on the appropriate tab):

- **Limits** — This view (shown in Fig. 60) contains 5 tabs for establishing the Low and High Warning limits and the Minimum and Maximum Error limits for all detectors, tracers, and QA Types. The tab you select here governs which Control Chart and QA Report will be respectively generated in the Chart and Report views.

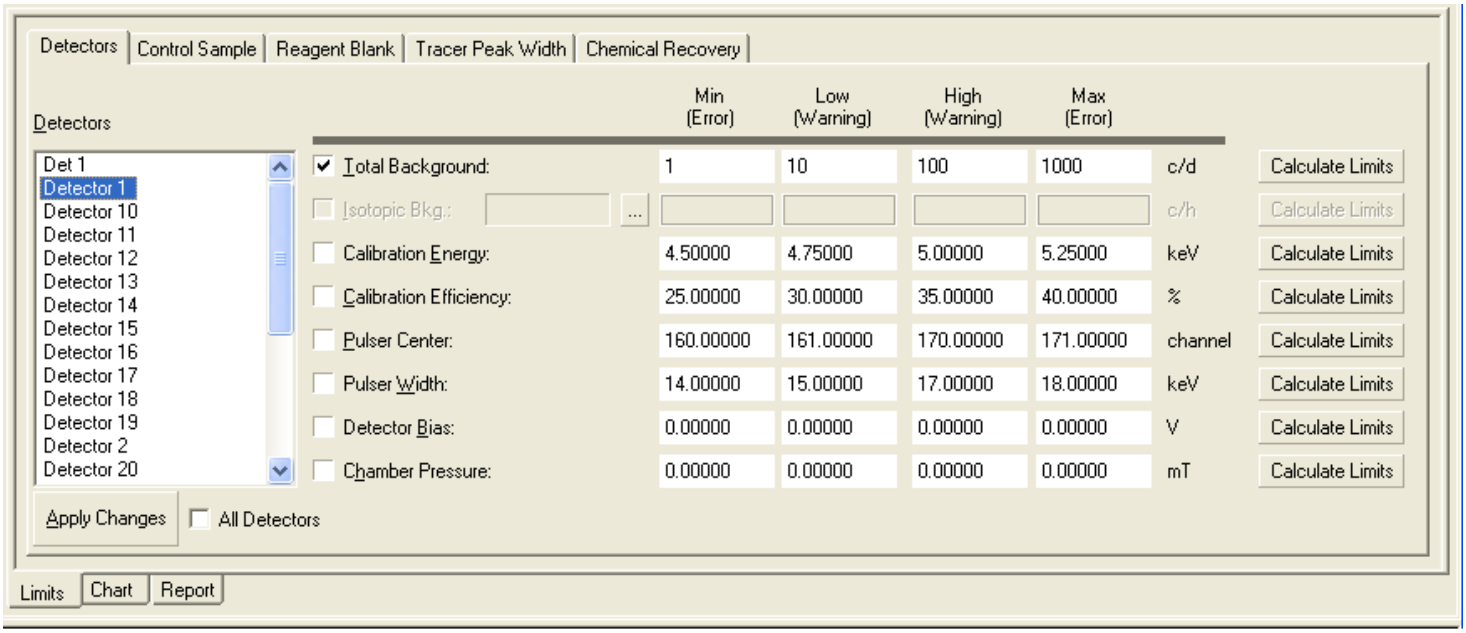


Fig. 60. The QA Panel, Detectors Tab.

- **Chart** — QA data are displayed on charts that can be produced for weekly, monthly, quarterly, yearly, project lifetime, or customized intervals. These charts display both the data and the set limits for each QA parameter, and update in real time as new information is added to the AlphaVision database. The appearance of the Control Charts is tied directly to the set points entered on the Limits tab. **Error** limits are drawn in red long dashes and **Warning** limits in blue short dashes.

- **Report** — This opens the standard Report Window. QA Reports include a picture of the associated Control Chart, the QA limits, and the mean and standard deviation of the data displayed.

3.2.4. The Library, Tracer, ROI, and QA Type Editors

These are covered in detail in the HTML Help Manual, and their use is detailed in the Chapter 5 tutorial.

3.2.4.1. The Library Editor

There are three major types of AlphaVision libraries, accessible from the Edit menu:

- The Master Nuclide Library of alpha-particle-emitting nuclides, supplied with AlphaVision v5.6 (**Edit/Master Nuclide List...**).
- The Analysis libraries including AlphaMaster (**Edit/Nuclide Libraries...**).
- Libraries for calibration sources and libraries for stock control solutions (**Edit/Standards...**).

AlphaVision libraries contain the nuclide name, half-life, alpha-particle peak energies, and branching ratios for each constituent. The Master Nuclide Library is a compilation of nuclear data from PCNuDat (National Nuclear Data Center, Brookhaven National Laboratory).

There is no limit to the number of peak energies per nuclide (unlike earlier versions of AlphaVision, which were limited to four peaks per nuclide). The nuclide peak with the highest branching ratio is used for the peak search.

Building Libraries

The AlphaVision v5.6 nuclide library interface is intuitive and takes just seconds to use. From inside the calibration and analysis library editors, simply open the master list, click on the nuclides you want (Fig. 61), then click on **OK** — the hardest part may be choosing the new library's name.

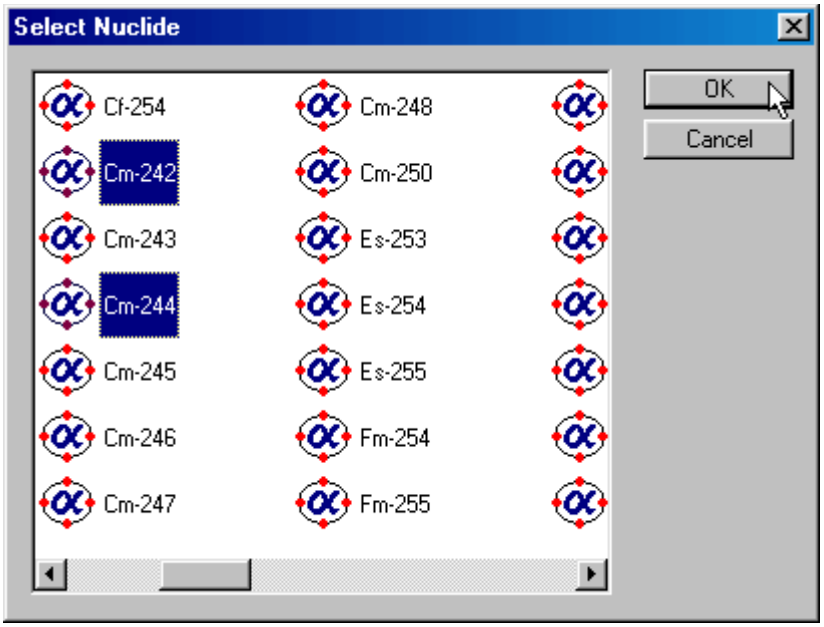


Fig. 61. Select Library Nuclides With a Few Mouse Clicks.

For peak-search-and-fit analyses, we recommend that you create libraries that match as closely as possible the expected nuclides in the samples. This is because the AlphaVision peak-search algorithm looks through the analysis library for the peak closest in energy to the identified peak in the spectrum. Too many nuclides with close or overlapping alpha-emission energies may lead to misidentification of a peak. In addition, while you will not require a large number of libraries for routine work, we suggest that you create different libraries for each analyte type (e.g., Am, Pu, U, Th).

If you know that each alpha peak in your sample is well separated from the others, you may not have to create specialized analysis libraries. In this case, because AlphaVision v5.6 can sum the branching ratios included within a region of interest (ROI), all you might need is the Master Library. Just select it within the sample processing wizards and let AlphaVision do the rest.

Once you have created a library in AlphaVision, you can quickly customize it by adding or removing peak energies and changing energy values. When the library is no longer needed, you can delete it.

3.2.4.2. The ROI Editor

To open the ROI Editor, click on **Edit/ROI...** or click on ROI Setup on the Analysis Setup page in the Batch or Background Wizard. You can also open the ROI Editor during manual calibration. This dialog enables you to:

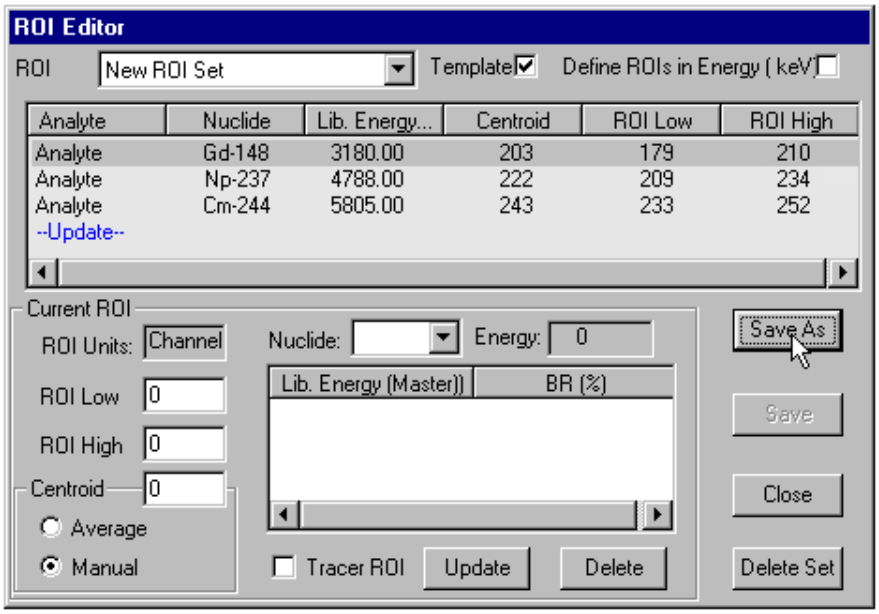


Fig. 62. Select Library Nuclides With a Few Mouse Clicks.

- Create a new ROI Set manually by entering the ROI start and end channels from the keyboard or interactively in conjunction with the mouse and a displayed spectrum.
- Edit an ROI Set manually or interactively, as described in Chapter 5.
- Define the peaks in the ROI Set in terms of channels or energy.
- Delete an ROI Set.
- Designate specific ROI Sets as ROI templates or non-templates, and use these designations to filter the ROI Set droplist for the two categories of ROI records.

Instructions for creating and editing ROI Sets begin on page 85.

3.2.4.3. The QA Type Editor

AlphaVision uses QA Types (**Edit/QA Types...**; Fig. 63) as tools for tracking the recovery history of tracers and control samples, and the count rate of reagent blanks for specific projects. There are three QA Types:

- **Chemical Recovery** — Tracks the chemical recovery (or yield) of a tracer, and is selected at the Batch Properties level. It allows you to quickly discriminate between different sample types within a project, and between similar (but perhaps not quite identical) sample types for different projects.
- **Control Sample** — Tracks the recovery of control standards for specific projects, and is selected at the Sample Properties level. In conjunction with Control Solution records, it

allows you to create one Control Solution for a given element and vary the volume added from batch to batch within 1 or more projects. AlphaVision v5.6 tracks the recovery regardless of the volume added from batch to batch.

- **Reagent Blank** — Tracks the count rate of batch blanks for specific projects, and is selected at the Sample Properties level.

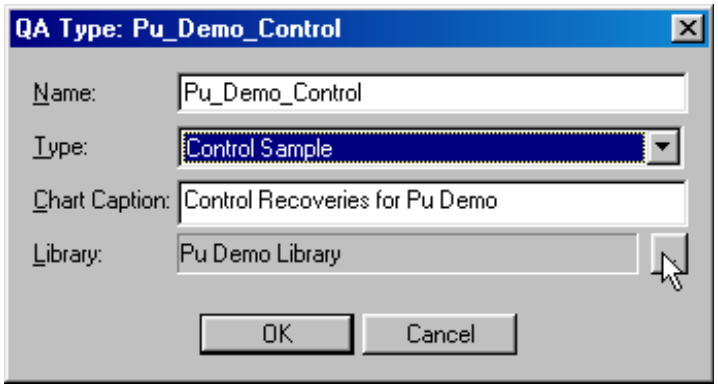


Fig. 63. Create QA Types to Track Recoveries and Count Rates.

Creating QA Types

To create a QA Type, assign a name to the new type, select which category of QA Type you are creating, and enter a descriptive title for the corresponding QA Control Chart that will display the recovery history for this new type. For Control Samples and Reagent Blanks, you must also select an appropriate nuclide library to be used in determining nuclide recoveries.

Create as many instances of each QA Type as you wish, at any time.

Each time you create a new Control Sample or Reagent Blank QA Type, and before analyzing samples that use the new QA Type, go to the corresponding Control Sample and Reagent Blank tabs on the QA/QC Panel, select the new **QA Type**, choose the **Nuclides**, and enter limits for them. This activates AlphaVision's automatic QA records update for these two QA Type categories.

3.2.5. The Analysis Setup Wizards

AlphaVision v5.6 has four wizards (see the **Process** menu in **Batch**, **Calibration**, and **QA** modes) to guide you, step by step, through the setup of all parameters for Batch, Background, Calibration, and Pulser Test data acquisition and analysis. These wizards allow you to streamline the repetitive aspects of sample analysis by creating special records called *templates* that hold customized sets of data acquisition parameters, analysis specifications, and reporting preferences. Once you've created the templates you need for your various projects, start one of the wizards, choose the template you wish to use, enter the batch- and/or sample-specific data, and you're ready to start data collection.

3.2.6. Data Acquisition Controls

AlphaVision v5.6 gives you 7 tools for controlling data acquisition:

1. The Calibration acquisition is performed on the detector currently selected (outlined in blue) on the Detector Grid. It starts automatically when you click on **Finish** in the Calibration Wizard, unless you specify otherwise on the first page of the Calibration Wizard.

2. If you choose to delay the count, you can count later in the Calibration Explorer Panel. Right-click on a calibration record that shows a **New** status and select **Start** from the right-mouse-button menu.

3. Batch, Background, and Pulser QA Test acquisitions use one or more detectors at a time. They are normally started from the Detector Assignment Worksheet, which enables you to assign detectors to samples either manually or automatically and then start acquisition.

4. Alternatively, you can choose to delay the count, then count later in the Batch Explorer Panel. In the Batch Explorer Tree (the left side of the Batch Explorer), right-click on the batch of interest, and select **Count** from the right-mouse-button menu. This will count or recount the entire set of samples. You can also select a batch, go to the Sample Analysis Explorer (the right side of the Batch Explorer) and choose 1 or more samples (not spectra or analyses) for a recount, then right-click and select **Count** from the right-mouse-button menu.

5. AlphaVision v5.6 allows you to perform "on-the-fly," interim analyses during data acquisition. In the Batch Explorer, right-click on the batch of interest to display its samples. Right-click on a sample and select **Interim Analysis...**. AlphaVision performs an analysis and records a "snapshot" of the spectrum at this point in the count. The interim analysis is displayed in the Sample Explorer Panel along with the regular analysis results, and becomes a permanent part of the data record for the batch. You can perform a new interim analysis approximately every 5 minutes.

6. Modify Acquisition Presets allows you to increase or decrease **Live Time** and/or **Real Time** presets for an entire set of Batch samples, Background measurements, or Pulser QA Tests. On the Batch Explorer Panel, locate and right-click on the batch record you want, then right-click and select **Modify Acquisition Presets** from the right-mouse-button-menu.

7. The Detector Menu (right-click on a detector icon) provides the final set of acquisition controls: **Pause**, **Continue**, **Abort**, **Stop**, and **Clear** detector memory. These operate only on the currently selected detector.

3.2.7. The Spectrum Window

The Spectrum Window is available only in **Batch** and **Calibration** modes. To display it, click on the Spectrum tab at the bottom of the Batch or Calibration Explorer Panel.

3.2.7.1. Right-Mouse-Button-Menu

Right-clicking in this window opens a menu (see Fig. 64) that allows you to **Zoom In** to see more spectrum details; return to a **Full View** of the spectrum; display the full-spectrum-view **Thumbnail Window**, the **Residuals Spectrum**, and/or the **ROI Bars** (which mark the start and end channels of each ROI); modify an existing ROI Set for a sample reanalysis (**Interactive ROI Analysis**, discussed in Section 1.5.5.2); and adjust the spectrum display **Properties...**.

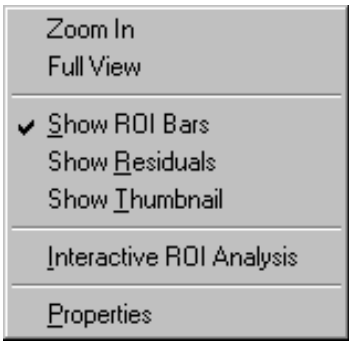


Fig. 64. The Right-Mouse-Button Menu.

Figure 65 shows the Thumbnail, Residuals Spectrum, ROI Bars, and right-mouse-button menu.

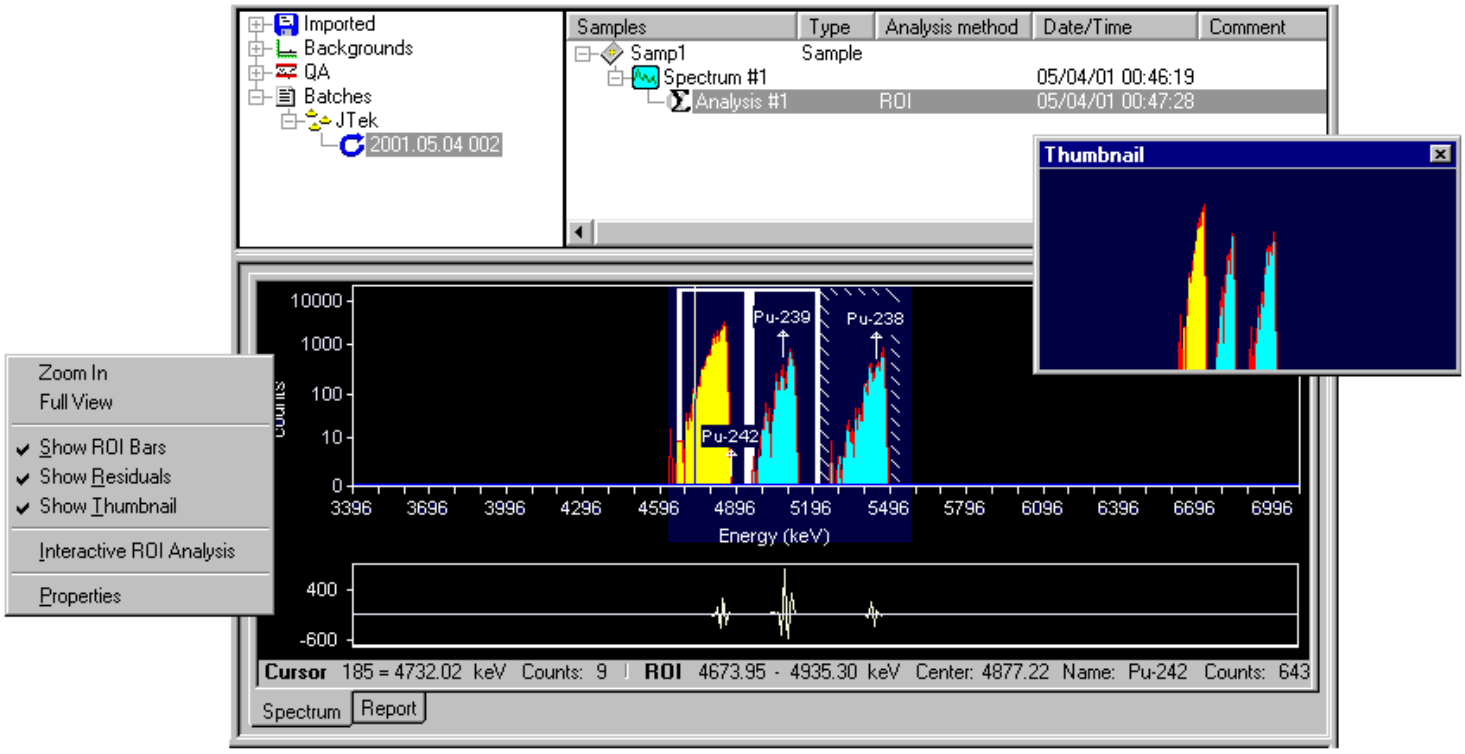


Fig. 65. Spectrum Window Features in Batch Mode.

Note the Marker Information Line at the bottom of the Spectrum Window. It reports the position of the vertical *marker line* (located in the ^{242}Pu peak in this illustration), including the marker location in channels and energy, the counts in the current channel, and any ROI and/or nuclide

identification information. Sections 3.2.7.3 and 3.2.7.3 describe the accelerator keys that move the marker and adjust the spectrum's horizontal and vertical scaling.

Figure 66 shows the dialog for the **Properties** command. It allows you to change Spectrum Window colors.

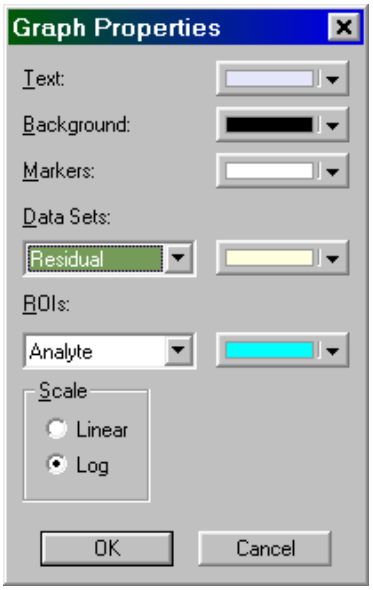


Fig. 66. Change Spectrum Colors.

If the detector for the current spectrum was calibrated when the spectrum was acquired, the spectrum will be displayed in energy units (keV or MeV). If the detector was uncalibrated, the spectrum will be displayed in channels. If you are viewing a spectrum analysis, clicking on the Report tab at the bottom of the Spectrum Window opens the Report Window and generates the associated report. (Both the Calibration and Analysis Reports include a picture of the analysis spectrum.)

3.2.7.2. Zoom Commands on the Right-Mouse-Button Menu

The **Zoom In** command gives you a second way — in addition to the Thumbnail view — to take a closer look at your spectra. In the Spectrum Window (not the Thumbnail), click and drag the mouse pointer over a portion of the spectrum to surround it with a *rubber rectangle*, then release the mouse button. The Spectrum Window will automatically adjust the horizontal and vertical scaling to display the area enclosed in the rubber rectangle.

To zoom out to a view of the entire spectrum, simply right-click in the Spectrum Window and select **Full View**. The window scaling will adjust to display the entire horizontal and vertical extent of the spectrum.

3.2.7.3. Scaling and Cursor Movement Features

For your convenience, the AlphaVision v5.6 spectrum window now use many of the horizontal and vertical scaling and cursor movement keys employed in MAESTRO.

NOTE *These accelerators function only when the Thumbnail window is* ***closed****.*

Next Channel <→>/<←>

The right and left arrow keys move the marker by one displayed pixel in the corresponding direction. If you have zoomed in, expanding the horizontal scale, when the marker reaches the edge of the spectrum window, the next key press past the edge shifts the window to the next block of channels in that direction such that the marker is now in the center of the display.

Zoom In/Zoom Out **Keypad<+>/<->**

Keypad<+> decreases the horizontal scale in the Expanded Spectrum View so the peaks appear larger, and **Keypad<->** increases the horizontal scale, making the peaks look smaller.

Taller/Shorter **<↑>/<↓> and <F5>/<F6>**

The <↑> and <↓> keys decrease or increase the vertical full scale of the displayed spectrum so the peaks appear taller or shorter, respectively.

Narrower/Wider **<F7>/<F8>**

These keys increase or decrease the horizontal scale of the data display so the peaks appear narrower or wider, respectively.

Use the **Full View** command to restore the spectrum to its default scaling.

3.2.8. The Report Window

All AlphaVision v5.6 reports share the same type of Report Window (Fig. 67), which allows you to view, print, or export the report data to a variety of formats (see the HTML Help Manual for more information on export formats). AlphaVision's reports are completely dynamic. That is, previously generated reports are not stored; they generate directly from the pertinent analysis record(s) each time you click on the Report tab.

To view reports:

- Zoom in on the desired spectral feature(s) that you wish to display on page 1 of the report. Otherwise, to display the entire spectrum, right-click in the Spectrum Window and choose **Full View**. Note that the *Nuclide Summary* section of the report will always contain the information for all ROIs in the spectrum, not just the ROIs currently displayed in the Spectrum Window.

- Go to the bottom of the center panel in **Calibration**, **Batch**, or **QA/QC** mode and click on the Report tab (alternatively, you can click on Report after you have selected the analysis you wish to view).

- In **Calibration** mode, click on a detector, then go to the Calibration Explorer and select the calibration you wish to view. This will generate the report.

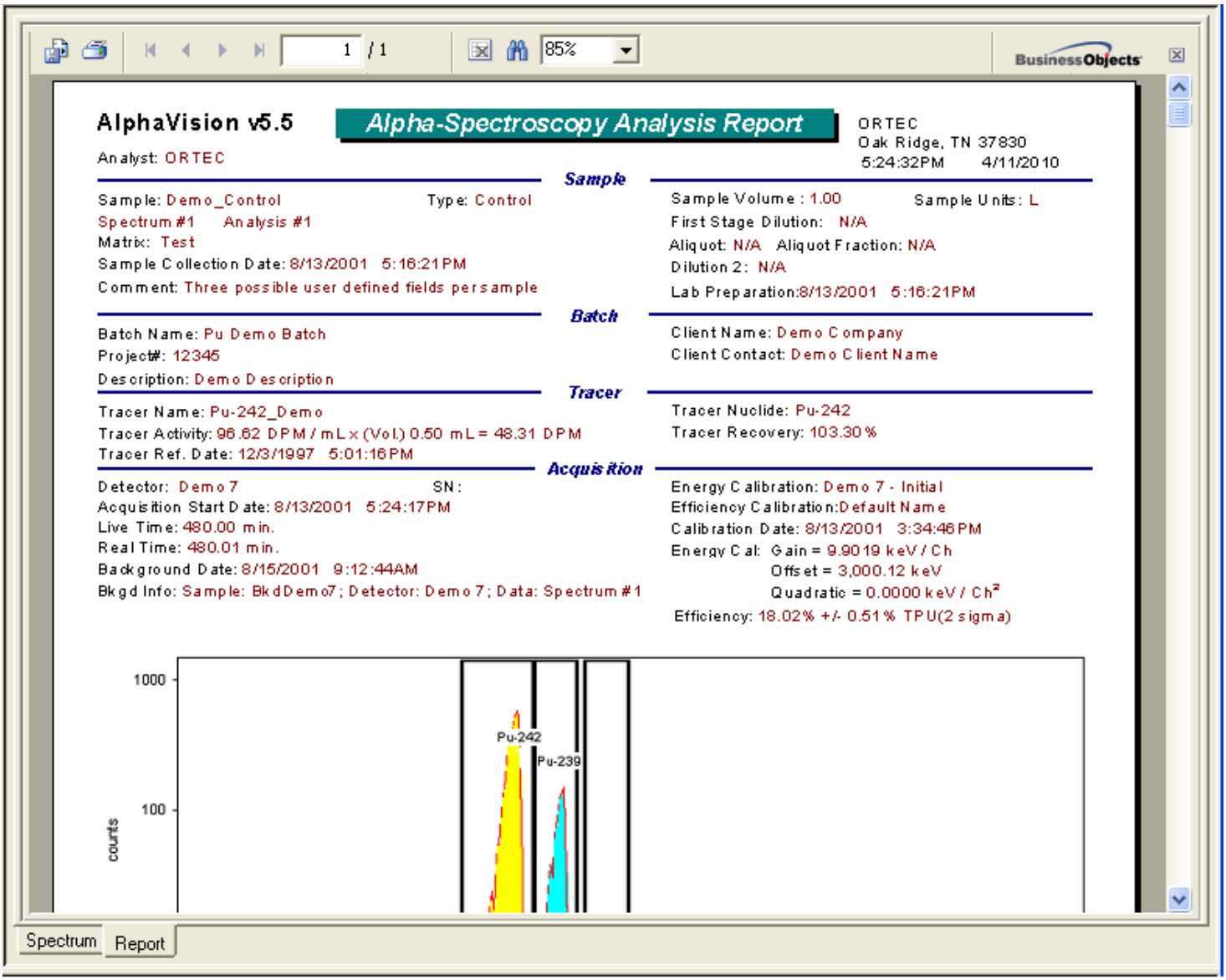


Fig. 67. The Report Window.

- In **Batch** mode, go to the Batch Explorer Panel and locate the analysis you wish to view (not the spectrum). Click on the analysis entry to generate its report.

- In **QA/QC** mode, run the QA test (if necessary) then click on the tab for the test you wish to view.

- For the hardware tests (calibration, pulser, background, bias, chamber pressure), go to the Detectors tab and select a particular detector, then click on the radio button for the test parameter you want. The report will generate.

- For Control Sample, Reagent Blank, and Chemical Recovery tests, click on the tab you want, then select a particular QA Type from the list. The report will generate.

3.2.8.1. Report Export Formats

AlphaVision v5.6 reports can be exported in the following formats:

- Adobe Acrobat (**.PDF**)
- Crystal Reports (**.RPT**)
- HTML 3.2
- HTML 4.0
- Microsoft Excel 97/2000 (**.XLS**)
- Excel 97/2000, data only (**.XLS**)
- Microsoft Word (**.RTF**)
- Microsoft Word, rich text (**.RTF**)
- ODBC
- Record style, columns with spaces (**.REC**)
- Record style, columns without spaces (**.REC**)
- Report definition (**.TXT**)
- Rich text format (**.RTF**)
- Separated values (**.CSV**)
- Tab-separated text (**.TTX**)
- Text (**.TXT**)
- **.XML**

3.2.9. The Event Window

The *Event Window* (**View/Event Window**), shown in Fig. 68, is AlphaVision's error and system tracking tool. AlphaVision uses this method instead of standard popup messages to streamline your interactions with the software when running numerous samples simultaneously. The Event Window records software events, their severity (Information, Warnings, and Errors), the software module in which the events occurred, and the date and time for occurrences including:

- Calibration failures
- Analysis failures
- QA warning or error limits exceeded
- Start and end of data collection
- Counting interrupted when a detector chamber exceeds pressure or leakage current limits
- Counting resumes when detector chamber returns within pressure and leakage current limits
- Detector is taken out of or returned to service
- Instrument Configuration program used to update the Master Detector List

We strongly recommend that you routinely check the Event Window during and after data acquisition, analysis, and QA/QC. If you wish, you can leave this window open, resize it, and move it to an unused part of the screen (click and drag on the title bar).

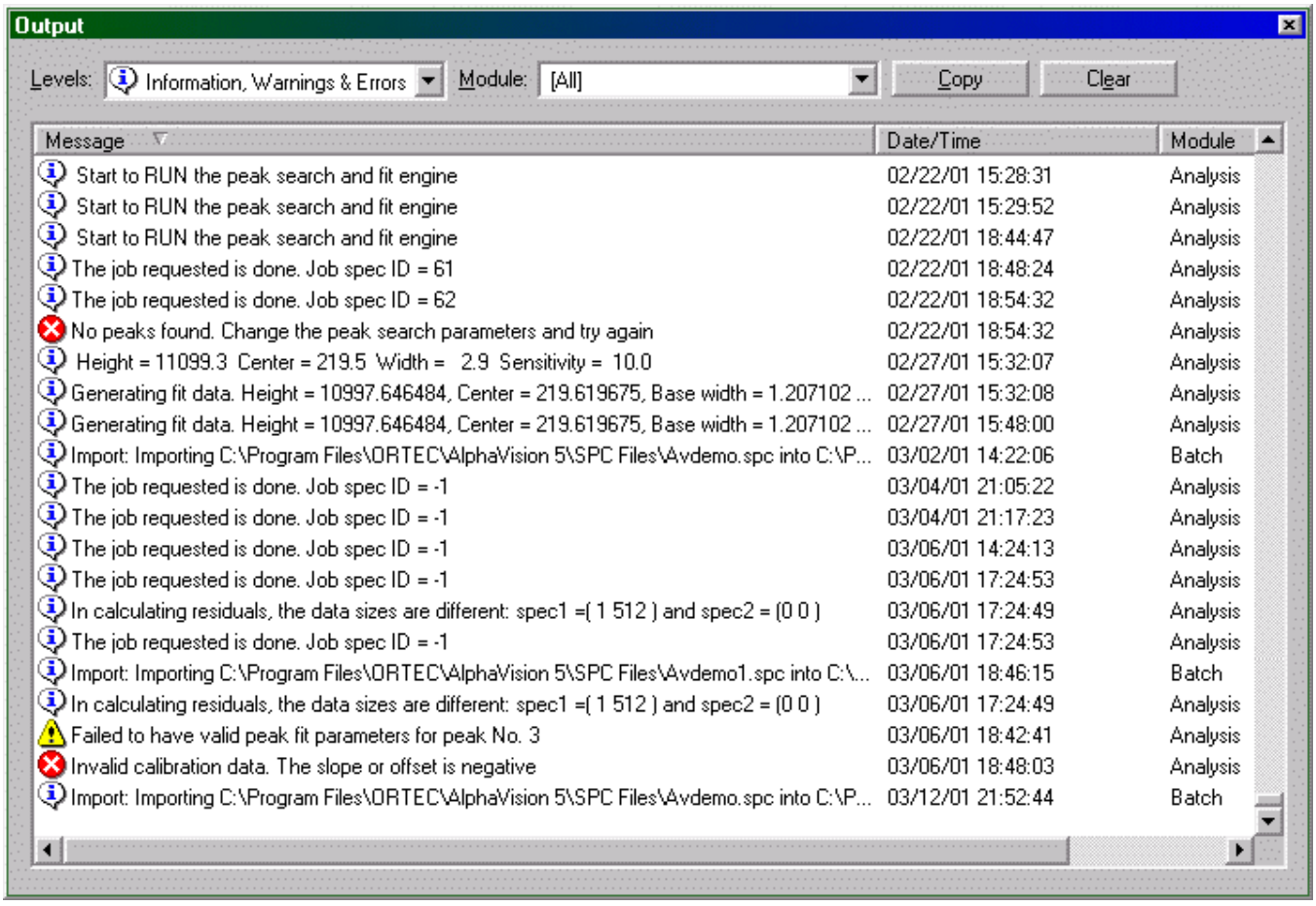

Output
Levels: Information, Warnings & Errors
Module: [All]
Copy
Clear
Message
Date/Time
Module
Start to RUN the peak search and fit engine 02/22/01 15:28:31 Analysis
Start to RUN the peak search and fit engine 02/22/01 15:29:52 Analysis
Start to RUN the peak search and fit engine 02/22/01 18:44:47 Analysis
The job requested is done. Job spec ID = 61 02/22/01 18:48:24 Analysis
The job requested is done. Job spec ID = 62 02/22/01 18:54:32 Analysis
No peaks found. Change the peak search parameters and try again 02/22/01 18:54:32 Analysis
Height = 11099.3 Center = 219.5 Width = 2.9 Sensitivity = 10.0 02/27/01 15:32:07 Analysis
Generating fit data. Height = 10997.646484, Center = 219.619675, Base width = 1.207102 ... 02/27/01 15:32:08 Analysis
Generating fit data. Height = 10997.646484, Center = 219.619675, Base width = 1.207102 ... 02/27/01 15:48:00 Analysis
Import: Importing C:\Program Files\ORTEC\AlphaVision 5\SPC Files\Avdemo.spc into C:\P... 03/02/01 14:22:06 Batch
The job requested is done. Job spec ID = -1 03/04/01 21:05:22 Analysis
The job requested is done. Job spec ID = -1 03/04/01 21:17:23 Analysis
The job requested is done. Job spec ID = -1 03/06/01 14:24:13 Analysis
The job requested is done. Job spec ID = -1 03/06/01 17:24:53 Analysis
In calculating residuals, the data sizes are different: spec1 =(1 512) and spec2 = (0 0) 03/06/01 17:24:49 Analysis
The job requested is done. Job spec ID = -1 03/06/01 17:24:53 Analysis
Import: Importing C:\Program Files\ORTEC\AlphaVision 5\SPC Files\Avdemo1.spc into C:\... 03/06/01 18:46:15 Batch
In calculating residuals, the data sizes are different: spec1 =(1 512) and spec2 = (0 0) 03/06/01 17:24:49 Analysis
Failed to have valid peak fit parameters for peak No. 3 03/06/01 18:42:41 Analysis
Invalid calibration data. The slope or offset is negative 03/06/01 18:48:03 Analysis
Import: Importing C:\Program Files\ORTEC\AlphaVision 5\SPC Files\Avdemo.spc into C:\P... 03/12/01 21:52:44 Batch

Fig. 68. The Event Window.

3.2.10. MCA View — Open MAESTRO From Within AlphaVision

If MAESTRO-32 is installed on the host PC (see Section 1.4.11), the **MCA View** command is available from the Detector Grid. A full-featured session of MAESTRO-32 opens in an independent window and runs concurrently with AlphaVision. This gives you the flexibility to collect data and analyze spectra outside of AlphaVision. It lets you perform quick counts for methods development work, test sources, and source activity checks. These data are not stored in the AlphaVision database, but can be saved in a number of formats including **.SPC** files and ROI Reports, as described in the MAESTRO *Software User's Manual*. (And, if you wish, you can then import the **.SPC** files into AlphaVision with the **File/Import...** command.)

To use this command, right-click a detector icon on the Detector Grid, and choose **MCA View** from the right-mouse-button menu. This starts MAESTRO and displays the contents of the selected detector. To monitor another AlphaVision detector in MAESTRO, just right-click on another detector icon and select **MCA View** again. To close the MAESTRO window, click on its **File/Exit** command or its upper-right × (Close) box.

4. DATA MANAGEMENT OVERVIEW

Data management is key to (1) maintaining a comprehensive chain of custody over your clients' samples and (2) keeping control of hundreds of data records. AlphaVision v5.6's data management tools include:

- The interface between your LIMS and the AlphaVision v5.6 database (Section 4.1).
- The **Select Database** command on the **File** menu (Section 69), which allows you to easily switch between target databases for your batch and background results, libraries, templates, calibrations, QA results, and all other entries.
- The database management and archival tools discussed in Section 4.3.
- The Batch Explorer Panel — gateway to all of the sample, background, and QA information in the AlphaVision v5.6 database (Section 3.2.2).
- The Calibration Explorer Panel — access to all calibration information in the database (Section 3.2.1).
- The QA/QC Panel — your access to the QA control limits, Control Charts, and QA Reports (Section 3.2.3).
- Exporting analysis results (Section 4.4).
- Importing data from previous versions of AlphaVision (Section 4.5).

NOTE ***DO NOT attempt to modify the AlphaVision database!*** Use only the LIMS interface tables discussed in Section 4.1. We encourage you to query the database, and it's easy to set up your own tailored Crystal Report formats. However, if you must "explore" the database, make a copy of **AlphaVision.mdb** and explore that copy! We of course also recommend that you frequently make a backup copy of your database.

4.1. The LIMS-to-AlphaVision-Database Interface

AlphaVision v5.6 gives you the unique ability to interface alpha-spectrometry software with your Laboratory Information Management System (LIMS). The AlphaVision database includes LIMS-interface tables that are linked with the Batch Wizard. You can upload the data in these tables from your LIMS, reducing the number of transcription errors as well as the time needed for batch setup within the Batch Wizard. The batch analysis results in the AlphaVision database are linked referentially to the input parameters. After sample counting and analysis, these data can be easily extracted and transferred to your LIMS. Some knowledge of databases, Microsoft Access, and database programming are required. Your LIMS administrator will have to create

the link between your LIMS and the AlphaVision v5.6 database. You are allowed to modify only two AlphaVision tables, **LIMS-Batches** and **LIMS-Samples**, as described in Section 4.1.1.

There's a one-to-many relation between the **LIMS-Batches** to **LIMS-Samples** records, so the idea is that, through your LIMS, you will first input a new Batch record, fill it in with the desired batch- and sample-level information, then add all of its component samples to the **LIMS-Samples** table, setting the **BatchID** field to the new batch record's ID.

4.1.1. How the Process Works

As a batch of samples arrives at your laboratory, enter the batch and sample information into your LIMS. These data will be transferred to the AlphaVision v5.6 database through a process created by your LIMS administrator.

1. Start the Batch Wizard and on Screen 1, General, open the **Load from LIMS droplist**, pick one of the Batch IDs that were entered in your LIMS, then click on **Next**.

2. On the Batch Properties screen, you must choose the location in the Batch Explorer Tree where this batch will be displayed. (The LIMS/AlphaVision interface cannot perform this task for you.)

3. If the **Client information** and **User-defined keys** were entered in the LIMS, this information will already be present at the bottom of the Batch Properties screen. If it is not present, you can enter it at this time. Click on **Next**.

4. On the Sample Properties screen, the sample information will already be displayed (if it was entered in the LIMS). Any information that was not entered into the LIMS can be entered at this time.

5. You may wish to click on each of the samples in the batch and confirm their individual sample properties. Modify as necessary, then click on **Next**.

6. If you are using a template that includes all of the acquisition, analysis, and reporting options you want, you can now click on **Finish**. If you are not using a template or if you need to make changes to the current template's settings, continue through the remainder of the wizard.

7. When you click on **Finish**, if the **AutoDelete** flag in the **LIMS-Batches** table is Yes(True), the batch and all its samples will automatically be cleared from the interface tables so they're ready for the next data transfer (this step affects only the data-transfer tables and does not affect the other information in your LIMS or AlphaVision database).

8. The Detector Assignment Worksheet will open so you can assign detectors.

9. Click on the **Start Now** button.

4.1.2. LIMS/AlphaVision Interface Tables

4.1.2.1. LIMS-Batches

This information loads into the Batch Properties screen.

Field Name	Data Type	Description
ID	AutoNumber	Used for record sequencing only.
Name	Text (50 chars)	Name of this batch of samples.
QAType	Text (50 chars)	Name of Chemical Recovery Type for this batch (must be exactly the same as the QA Type name created in AlphaVision). Leave blank for no Chemical Recovery Type.
Template	Text (50 chars)	Name of Template to use for this batch (must be exactly the same as the batch Template name created in AlphaVision). Leave blank for no Template.
Description	Memo	Description of this batch.
ClientInfo	Text (50 chars)	Name of Client info for this batch (must be exactly the same as the Client Name created in AlphaVision). Leave blank for no Client Information.
User1Key	Text (50 chars)	User-defined Key.
User1Value	Text (50 chars)	User-defined Value associated with the Key.
CreationDate	Date/Time	Date/Time when this batch was created
AutoDelete	Yes/No	The default for this value is TRUE. When TRUE, the batch and its samples will be deleted from this table when their data have been transferred and are no longer needed.
EditTracerInSamplePage	Yes/No	

4.1.2.2. LIMS-Samples

This information loads into the Sample Properties screen.

Field Name	Data Type	Description
ID	AutoNumber	Used for record sequencing only.
BatchID	Number (Long)	Numerical ID for this batch of samples.
Name	Text (50 chars)	Sample name
Type	Number (Long)	One of the following values: 0 = Sample, 1 = Blank, 2 = Control, 3 = Background, 4 = Pulser
CollectionDate	Date/Time	
UseCollectionDate	Yes/No	
DecayCorrDate	Date/Time	
UseDecayCorrDate	Yes/No	
LabPrepDate	Date/Time	
UseLabPrepDate	Yes/No	
Volume	Number (Single)	
VolumeUnits	Number (Long)	One of the following values: 0 = L, 1 = mL, 2 = µL, 3 = m^3, 4 = cm^3, 5 = ft^3, 6 = in^3
VolumeUnc	Number (Single)	Uncertainty in percent
Weight	Number (Single)	
WeightUnc	Number (Single)	
WeightUnits	Number (Long)	One of the following values: 0 = g, 1 = kg, 2 = mg, 3 = µg
Aliquot	Number (Single)	Aliquot volume
AliquotUnc	Number (Single)	Uncertainty in percent
Comments	Text (255 chars)	Per-sample comments
QATypeID	Number (Long)	Name of QA Type for this sample (must be exactly the same as the QA Type name created in AlphaVision).
BulkVolume	Number (Double)	
BulkSourceID	Number (Long)	
User1Key	Text (50 chars)	User- defined key 1
User1Value	Text (50 chars)	User- defined value associated with key 1

Field Name	Data Type	Description
User2Key	Text (50 chars)	User- defined key 2 (does not appear on default report)
User2Value	Text (50 chars)	User- defined value associated with key 2 (does not appear on default report)
IsVolume	Yes/No	If using volume select TRUE; if weight select FALSE
UseAliquot	Yes/No	TRUE if using an aliquot
TracerAmountDefined	Yes/No	If TRUE, tracer amount is defined for this sample in this table. Set to TRUE only if tracer amount for each sample is different.
TracerAmount	Number (Single)	Tracer amount in mL for this sample
TracerAmountUncPct	Number (Single)	Tracer amount uncertainty for this sample
UseDilution	Yes/No	If TRUE, this sample has been diluted
Dilution1	Number (Single)	The first dilution factor (D1)
Dilution1UncPct	Number (Single)	The first dilution factor (D1) uncertainty
Dilution2	Number (Single)	The second dilution factor (D2)
Dilution2UncPct	Number (Single)	The second dilution factor (D2) uncertainty
Aliquot2	Number (Single)	The second aliquot amount
Aliquot2UncPct	Number (Single)	The second aliquot amount uncertainty

NOTES

1. If tracer has been defined for a sample in batch, it must be defined for all other smaples of the same batch

2. There is an example program on the CD called MiniLIMS with source code in Visual C++ which can help users to populate this table.

3. The first aliquot amount is in the field Aliquot (instead of Aliquot1).

4.2. Select Database

The new **Select Database...** command on the **File** menu allows you to select the target AlphaVision v5.x database for your project measurements. Now it’s fast and easy to store all of the batch and background results, libraries, templates, calibrations, and QA results for a specific project in its own database, simplifying Batch Tree construction and project records archival. When an AlphaVision data acquisition or analysis is in progress, this command is disabled.

To switch to a different database, click on **File/Select Database...** to open a standard Windows file-open dialog (Fig. 69). Choose a valid AlphaVision v5.x database and click on **Open**. AlphaVision will notify you that it must close and reopen to put the change into effect. Click **Yes** to automatically exit and restart AlphaVision. Click **No** to manually exit and restart.

NOTE *AlphaVision v5.6 can use only databases created with the new Database Management archive tool or cloned from an existing AlphaVision database.*

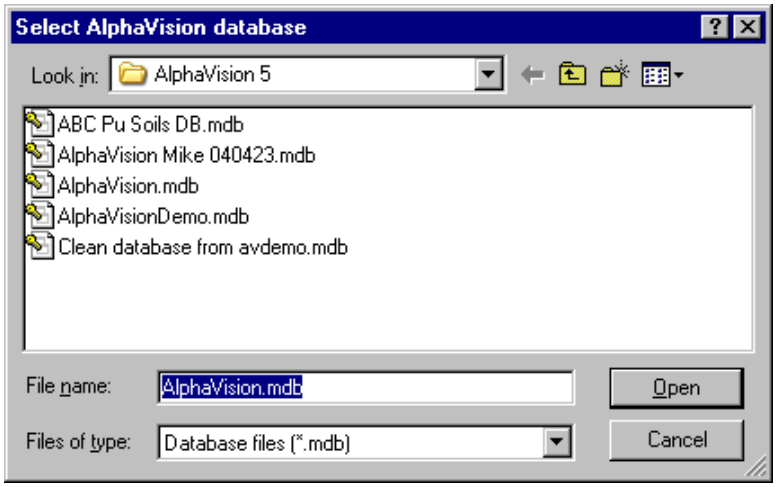


Fig. 69. Selecting a New Target AlphaVision Database.

4.3. Database Management

The **Database Management...** command is located on the **File** menu. Figure 70 shows the Database Management dialog, which allows you to:

- Archive the current database by saving a copy in **.MDB** file format (giving you a "snapshot" of the current database contents). This archive database can then be recalled at any time with the **File/Select Database...** command.

- Permanently delete one or more sample records from within a batch or delete an entire batch. This, in conjunction with the Batch Explorer, allows you to tailor the contents of your databases as needed.

- Compact a database to recover disk space after deleting records.

The dialog's titlebar shows the name of the current target database. To select a different database, use **File/Select Database...**.

The branches in the left-hand panel of the Database Management dialog mirror those in the main screen's Batch Explorer, with two exceptions: Unlike the Batch Explorer, this dialog displays the various template records (⊞ T Templates) in the current database, and, except for calibrations,

you can remove them as needed. However, imported records (Imported) are not shown here because, once imported, they cannot be deleted.

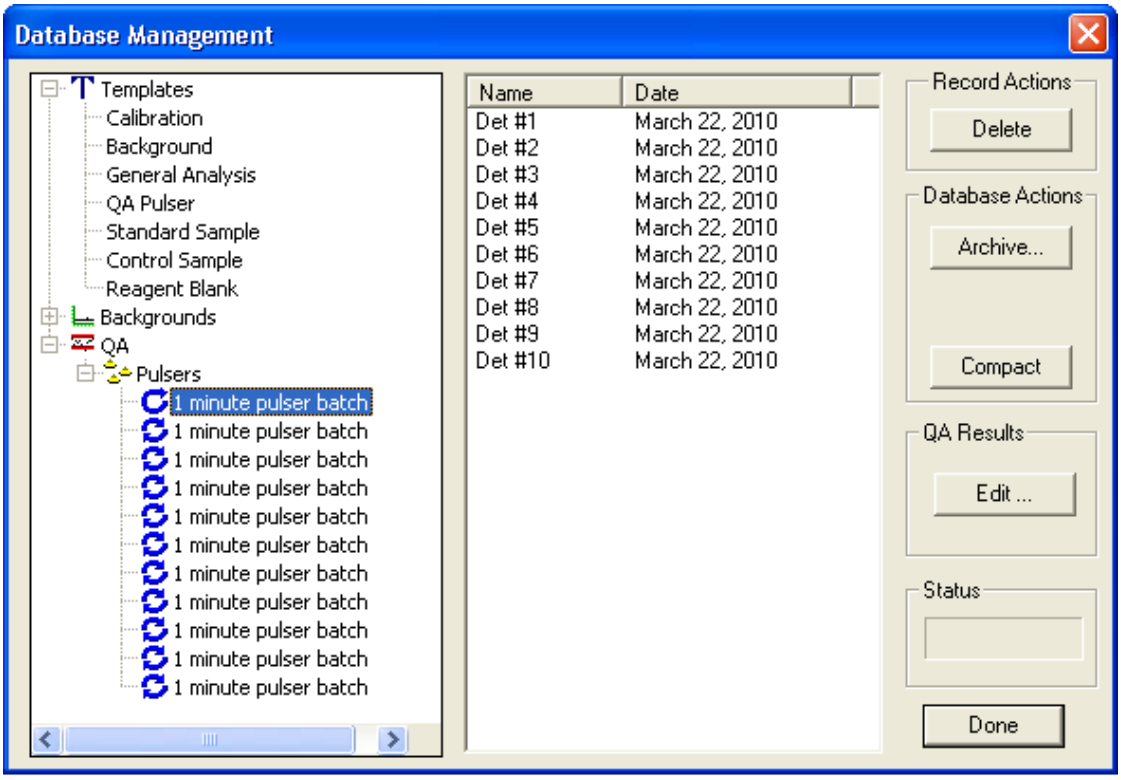


Fig. 70. Database Management Dialog, Showing Current Target Database.

The **Status** indicator in the lower right corner will indicate whether a deletion, archival, or compaction is in progress.

Click on **Done** to return to AlphaVision.

4.3.1. Deleting Records

Note that calibrations cannot be deleted, however, you can delete calibration *templates* using this dialog. In addition, you cannot remove a background that is in use by an analysis (you will receive an "Unable to delete some or all of the selected records. Background spectrum is used by other samples" message). You must first delete all the samples using that background.

To remove one or more sample measurements from the database, use the left-hand explorer panel to locate the batch, then click on the batch to display its component samples in the right-hand panel. Click on the sample to highlight it, then click on **Delete**. A message box will ask you

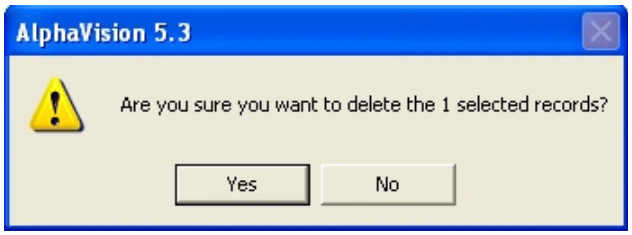


Fig. 71. Deleting One or More Sample Records.

to confirm the deletion (Fig. 71). To remove more than one sample at a time, use **<Shift + Left-click>** to highlight a contiguous block of measurements or **<Ctrl + Left-click>** to highlight discontinuous measurements, then click on **Delete**.

To remove an entire batch, click to highlight it *but do not highlight any of the samples within the batch*, then click on **Delete**. A message box will ask you to confirm the deletion (Fig. 72). While you can remove multiple samples from a batch at one time, you can only delete one batch at a time.

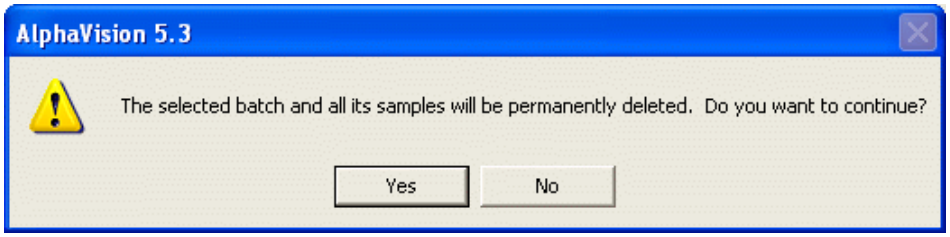


Fig. 72. Deleting an Entire Batch.

IMPORTANT ***There is no undo for a deletion. We strongly recommend that you archive your database before deleting any records!***

Once you have removed all of the batches in a branch, you can use the Batch Explorer to remove the branch; see Section 3.2.2.

4.3.2. Archiving a Database

To create a backup of the current database, click on **Archive...** to open a standard Windows file-save dialog (Fig. ?). Enter the path and filename you wish to use and click on **Save**.

4.3.3. Creating a "Clean" AlphaVision Database

If, after installation, you did not create a copy of the default, empty AlphaVision database for future use, you can use the **Archive** and **Delete** features together with the Batch Explorer to create a new, "clean" database for your next project. The **AlphaVisionDemo.mdb** file is a convenient starting database. Create a backup copy of it with the **Archive** feature, choose it as your target database with **File/Select Database...**, restart AlphaVision, use the database management tools to remove all records from it, then the Batch Explorer to remove all unwanted branches. You now have a blank AlphaVision database, ready to use.

4.4. Exporting Analysis Results from the Report Display Window

AlphaVision v5.6 allows you to export analysis results to a variety of destinations in the following formats:

- Adobe Acrobat (**.PDF**)
- Crystal Reports (**.RPT**)
- HTML 3.2
- HTML 4.0
- Microsoft Excel 97/2000 (**.XLS**)
- Excel 97/2000, data only (**.XLS**)
- Microsoft Word (**.RTF**)
- Microsoft Word, rich text (**.RTF**)
- ODBC
- Record style, columns with spaces (**.REC**)
- Record style, columns without spaces (**.REC**)
- Report definition (**.TXT**)
- Rich text format (**.RTF**)
- Separated values (**.CSV**)
- Tab-separated text (**.TTX**)
- Text (**.TXT**)
- **.XML**

These formats are available through the Report Display Window by clicking on the Export Reports icon on the top left of the Report Window. In addition, you can set up the Report Properties page of the four wizards to export reports to Excel 8.0, HTML 4, rich text format, text, Microsoft Word, **.PDF**, tabbed text, and **.XML**.

For an animated example of how to export your results, see *Exporting Analysis Results* in the HTML Help Manual.

4.5. Importing Older AlphaVision .SPC Files

Use the **File/Import...** command to import your older AlphaVision **.SPC** files into the new AlphaVision v5.6 database, one or more files at a time. Once you've imported older data, it's quick and simple to analyze them within AlphaVision v5.6, adding their results to the database. ***This import operation leaves your original data files completely intact.*** **.CHN** files can be converted to the **.SPC** format with the CONVERT program, which is included with MAESTRO-32.

Note the following about imported files:

- Imported files are displayed in the Batch Explorer Panel under **Imported/SPC Files**, in the order in which they are imported, and are labeled according to their original filename, without the **.SPC** extension (see the illustration below, which shows how the Batch Window looks after importing **.SPC** files). ***Before importing, you may want to ensure that your .SPC files have uniquely identifiable names***.

- The timestamp for each record is displayed in the Batch Window's sample column under the **Acquired Date/Time** header. However, you may find it easiest to locate an imported record if its filename (at the time of import) provides information about acquisition date or project.

- Duplicate record names ***are allowed***.

- Once imported into the AlphaVision v5.6 database, ***records cannot be deleted***.

- Previous versions of AlphaVision had a separate QA database. The contents of those QA databases cannot be imported directly into the AlphaVision v5.6 database.

For instructions on importing files, see the HTML Help Manual (**Help/Contents**).

5. ALPHAVISION v5.6 TUTORIAL

This tutorial illustrates the functions and features of the calibration, batching, background, and QA/QC processes in AlphaVision v5.6. The examples highlight typical tasks you will encounter in alpha spectrometry — including defining, storing and retrieving project analyses and data; and creating, storing and retrieving quality assurance records associated with a given project — and how these tasks are simplified using AlphaVision v5.6. This page takes you through a series of operations that present all of the steps necessary to calibrate your detectors, including creating Calibration Source and Tracer records; building and using nuclide libraries for calibration, analysis, and QA; creating QA Types and QC Charts for tracking the recoveries for each of your projects; and analyzing sample batches.

The tutorial covers the following topics:

Step 1: Adding detectors to your AlphaVision system

Step 2: Calibrating your detectors
- Creating calibration source records
- Setting up the Calibration Wizard, acquiring data, and creating an ROI record for the calibration

Step 3: Creating the control solution, nuclide library, tracer, and QA Type records necessary for sample analysis
- Control solution records
- Nuclide libraries
- Tracer records
- QA Types and QC Charts for tracking control sample and blank activities and chemical recoveries

Step 4: Analyzing sample batches
- Setting up the Batch Explorer Tree for a new project
- Setting up the Batch Wizard and acquiring data

Step 5: Measuring isotope-specific background

Step 6: Setting up and generating your Control Charts and reports

5.1. Project — Plutonium in Soil for ABC, Inc.

Our example is a project for ABC, Inc., that is expected to continue for five months. The first shipment consists of 3 soil samples to be measured for ^{239}Pu. ABC requires a blank and a control for every batch of samples. It further requires that a control chart of the control spike recoveries

(^{239}Pu) be submitted once per month for this project. In addition, the contract specifies that the background count rate in the ^{239}Pu region of interest be monitored and reported once per month for the detectors used to count samples and blanks. Uncertainties are to be reported at a 95% confidence interval (using 1.96 as the sigma multiplier). The MDA calculation is to use the batch blank and the ANSI equation (where $k_\alpha = k_\beta = 1.645$).

5.1.1. Materials

5.1.1.1. Samples

The examples below use ^{239}Pu as analyte and control, and ^{242}Pu as a tracer. To most effectively use this tutorial, we recommend that you create 3 "samples" of ^{239}Pu (containing ^{242}Pu as a tracer), one reagent blank, and one ^{239}Pu control.

5.1.1.2. Calibration Standards

To create a calibration source for AlphaVision v5.6, you'll first need to prepare a source in your wet-chemistry laboratory (or purchase it from a source manufacturer). Good references for the preparation and documentation of Standard Calibration Sources are ASTM C1128, 1989, Preparation of Working Reference Materials for Alpha-Spectroscopy and ASTM C1163, 1993, Preparation of Neodymium Fluoride Microprecipitated Sources for Alpha-Spectroscopy. We recommend that the nuclide energies for calibration encompass the entire region of interest for analytes of interest. For this tutorial, we use calibration sources containing ^{148}Gd (E_α = 3.18 MeV), ^{237}Np (E_α = 4.782 MeV), and ^{244}Cm (E_α = 5.805 MeV) — the peak energies shown here are the largest abundance peak energies for these nuclides.

5.1.1.3. Tracers and Control Solutions

Before you create tracer and control solution records in AlphaVision v5.6, you'll need to prepare these solutions in your wet-chemistry laboratory. A tracer is a solution standard that is used to calculate the chemical recovery for your samples. A control solution is a solution standard consisting of the analyte-nuclide of interest. In general, these standard solutions are prepared by diluting standard reference materials obtained from NIST or another reference laboratory or source manufacturer, or are purchased in diluted form directly from the source manufacturer.

5.1.2. Step 1 — Adding Detectors to AlphaVision v5.6

The first step is to add detectors to our Detector Grid so that we can access them in AlphaVision v5.6. For this tutorial, we are going to use five detectors.

1. Right-click on an empty cell on the Detector Grid and select **Show Master List...** from the right-mouse-button menu (Fig. 73).

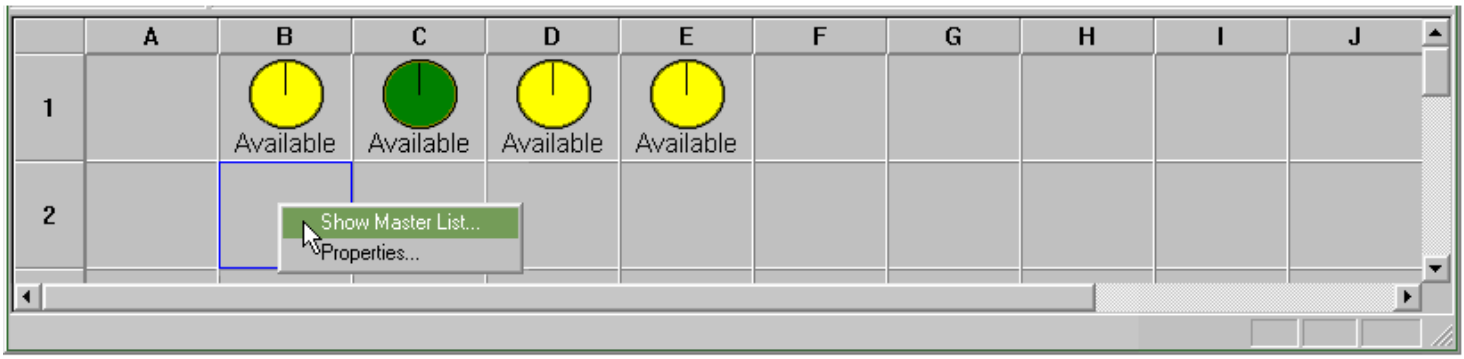


Fig. 73.

2. Figure 74 shows the Master Detector List. To add a detector to the grid, go to the Master Detector List, left-click and hold on the detector you want, drag it from the list to the grid (note the drag-and-drop icon in the illustration), and release the mouse button.

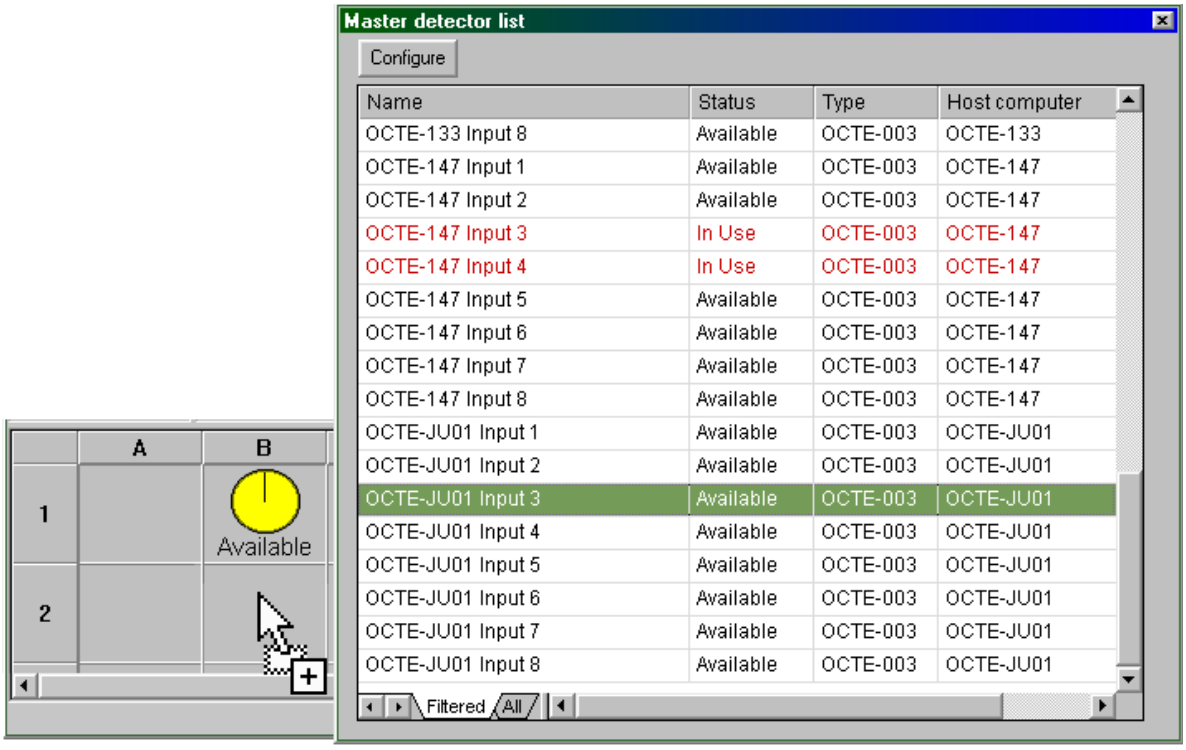

Master detector list
Configure
Name
Status
Type
Host computer
OCTE-133 Input 8 Available OCTE-003 OCTE-133
OCTE-147 Input 1 Available OCTE-003 OCTE-147
OCTE-147 Input 2 Available OCTE-003 OCTE-147
OCTE-147 Input 3 In Use OCTE-003 OCTE-147
OCTE-147 Input 4 In Use OCTE-003 OCTE-147
OCTE-147 Input 5 Available OCTE-003 OCTE-147
OCTE-147 Input 6 Available OCTE-003 OCTE-147
OCTE-147 Input 7 Available OCTE-003 OCTE-147
OCTE-147 Input 8 Available OCTE-003 OCTE-147
OCTE-JU01 Input 1 Available OCTE-003 OCTE-JU01
OCTE-JU01 Input 2 Available OCTE-003 OCTE-JU01
OCTE-JU01 Input 3 Available OCTE-003 OCTE-JU01
OCTE-JU01 Input 4 Available OCTE-003 OCTE-JU01
OCTE-JU01 Input 5 Available OCTE-003 OCTE-JU01
OCTE-JU01 Input 6 Available OCTE-003 OCTE-JU01
OCTE-JU01 Input 7 Available OCTE-003 OCTE-JU01
OCTE-JU01 Input 8 Available OCTE-003 OCTE-JU01
Filtered
All
A
B
1
2
Available

Fig. 74.

3. The detector's Properties dialog will open (Fig. 75). *You must enter a **Detector Name***. The remaining fields are not mandatory, however, they provide useful hardware documentation, and the information is saved in the AlphaVision database. Complete the remainder of the dialog and click on **OK**. The detector icon will change from the "Please Wait" hourglass to a "clock-face" icon.

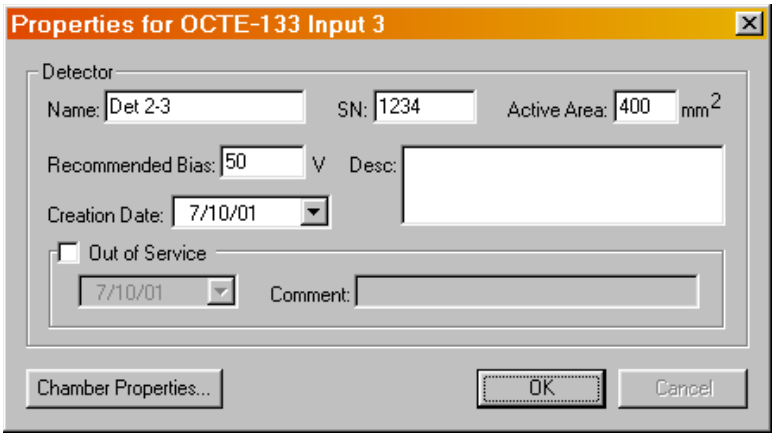


Fig. 75.

4. Figure 76 shows the Detector Grid after the fifth detector has been added. Continue adding detector icons as needed. Note that you can position the detector icons anywhere on the grid (except detectors that are acquiring) by just clicking and dragging them — for example, if you have three OCTÊTEs you may wish to cluster the icons for each instrument in different sectors of the grid. To simplify sample loading, we suggest that you arrange the icons to reflect the relative positions of the hardware in your counting lab.

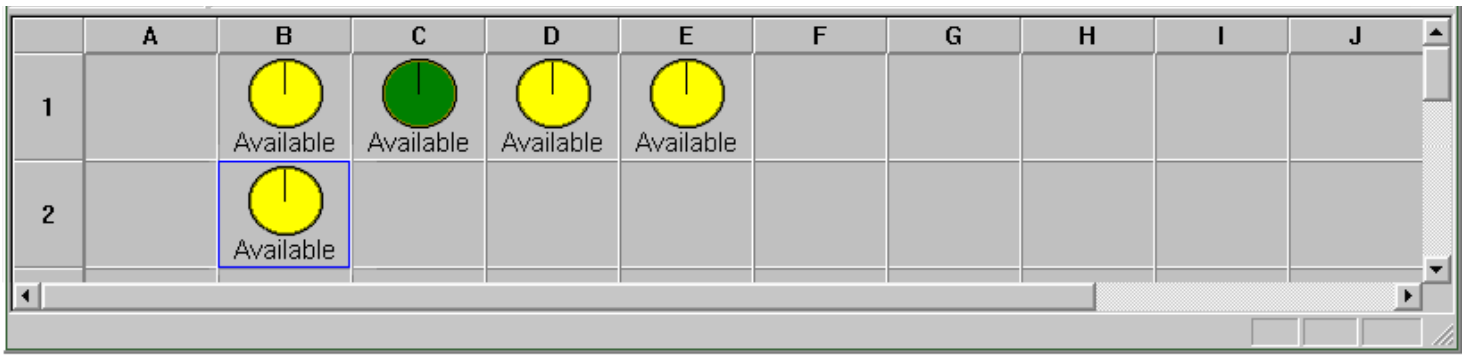


Fig. 76.

That’s all it takes to prepare your detector system for calibration!

5.1.3. Step 2 — Calibration

The next task is to calibrate your detectors. AlphaVision v5.6 uses a friendly setup wizard to speed the process of calibrating detectors; storing calibration data; and viewing the results onscreen, in Calibration Reports, and in QC Charts. *Note that you must have at least two energy peaks for calibrations*.

5.1.3.1. Creating a Calibration Source Record

The first step is to create a data record for the calibration source you'll be using (see also Section 5.1.1).

1. On the Outlook Toolbar, click on the **Calibration** icon.

2. From the menu bar, select **Edit/Standards**. This will open the Standards dialog (Fig. 77).

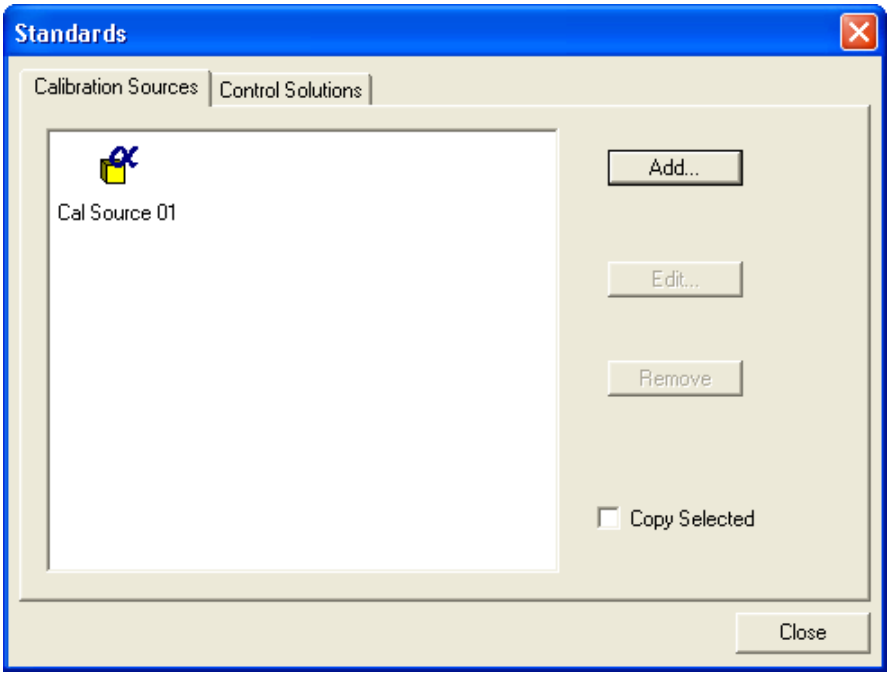


Fig. 77.

3. To add a Calibration Source, click on the Calibration Sources tab and choose **Add**. The Calibration Source dialog will open (Fig. 78).

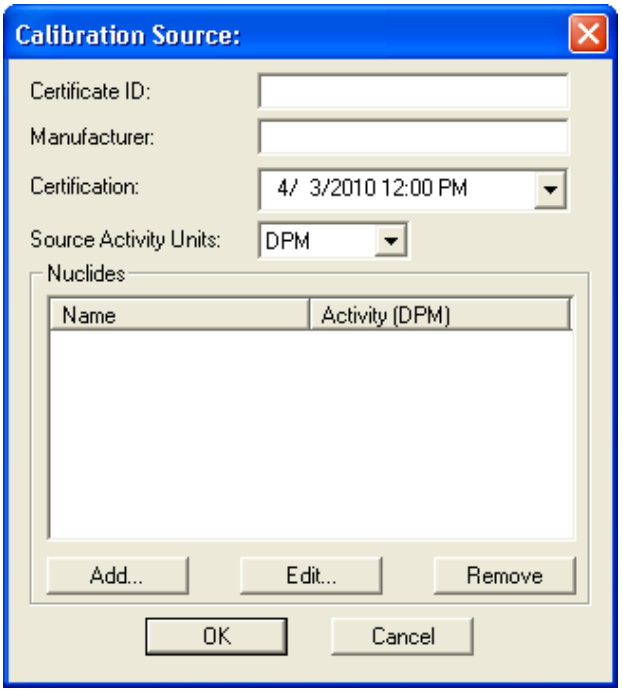


Fig. 78.

4. Enter the name of the calibration source (**Certificate ID**), **Manufacturer** (whether in-house or company), and **Certificate Date/Time** using the Date Tool (Fig. 79). The certification date is used to decay correct the activity of each of the nuclides contained on the standard source. You will need to decay correct the activity of each nuclide according to the certification date on the certificate of the standard used in source preparation. In this example, we are creating a Calibration Source record named *ABC Cal Source*.

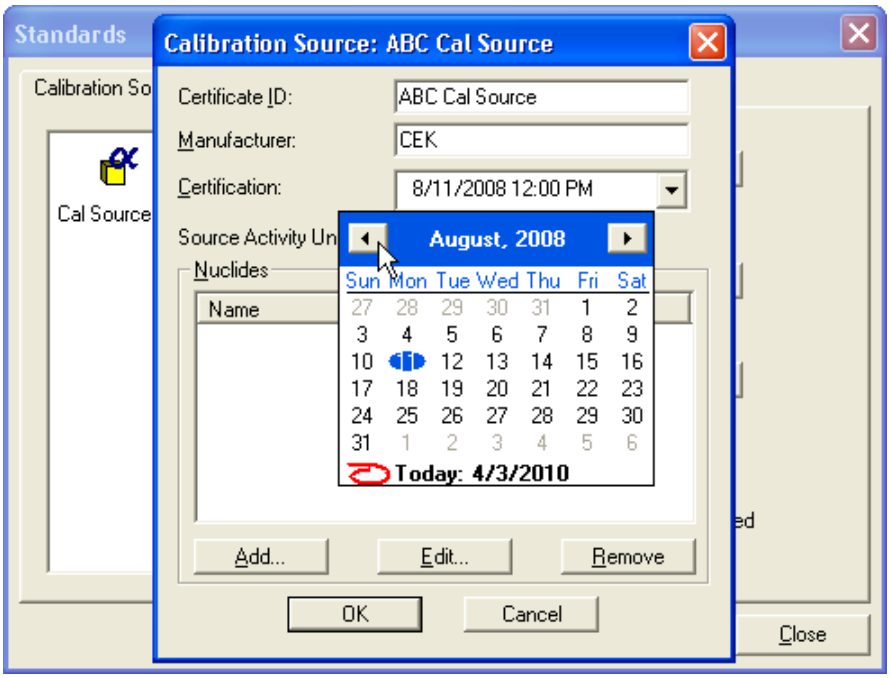


Fig. 79.

5. To add a nuclide to the Calibration Source record, click on **Add** to open the Nuclide Information dialog (Fig. 80).

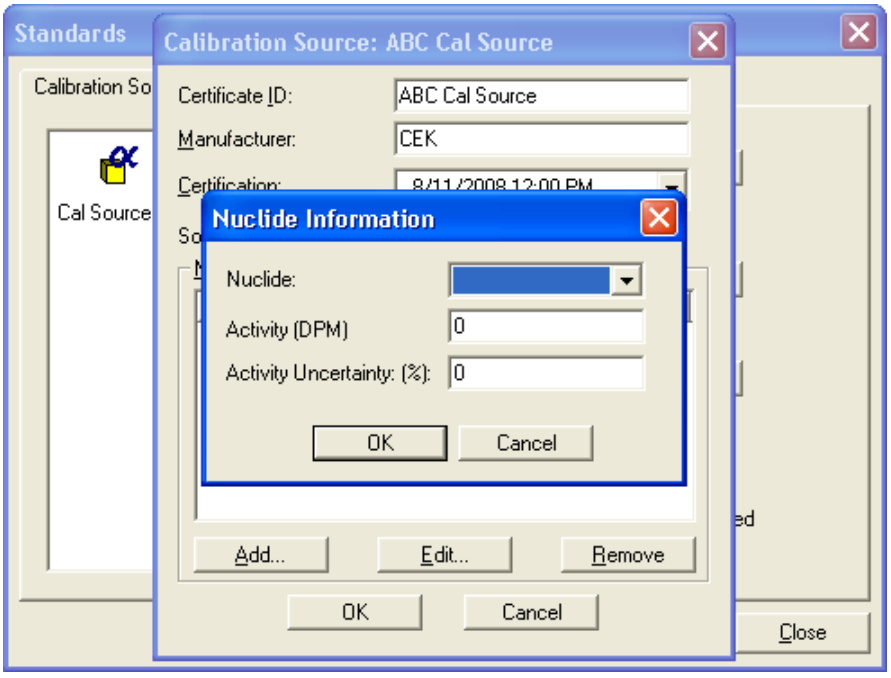


Fig. 80.

6. Select ^{148}Gd from the **Nuclide** droplist (Fig. 81) and enter its certified **Activity**. If you wish, you can also enter the percent **Activity Uncertainty** associated with the diluted standard (otherwise, leave it set to zero). This user-defined uncertainty is at the one-sigma level (and is normally based on the uncertainty associated with the preparation of the diluted standard and the stated uncertainty on the standard certificate). Click on **OK**.

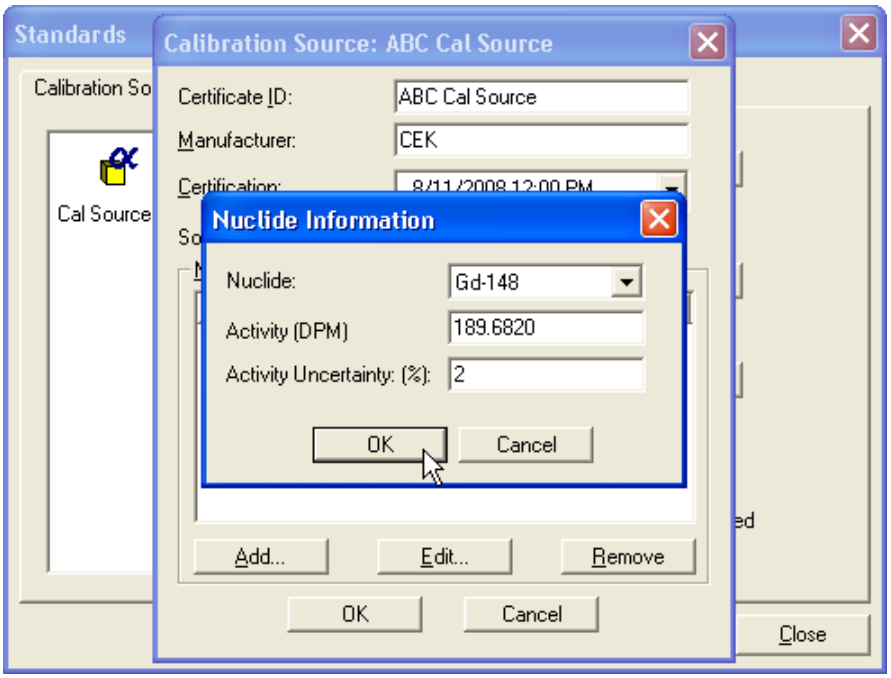


Fig. 81.

7. Repeat this procedure for ^{244}Cm and ^{237}Np (Fig. 82).

8. To modify an existing nuclide entry, click on the nuclide, click on Edit, make the necessary changes, and click on **OK**.

9. Once you have entered the activity and uncertainty for all the nuclides in your standard source, click on **OK** to return to the Standards dialog, then click on **Close** to return to the main AlphaVision screen.

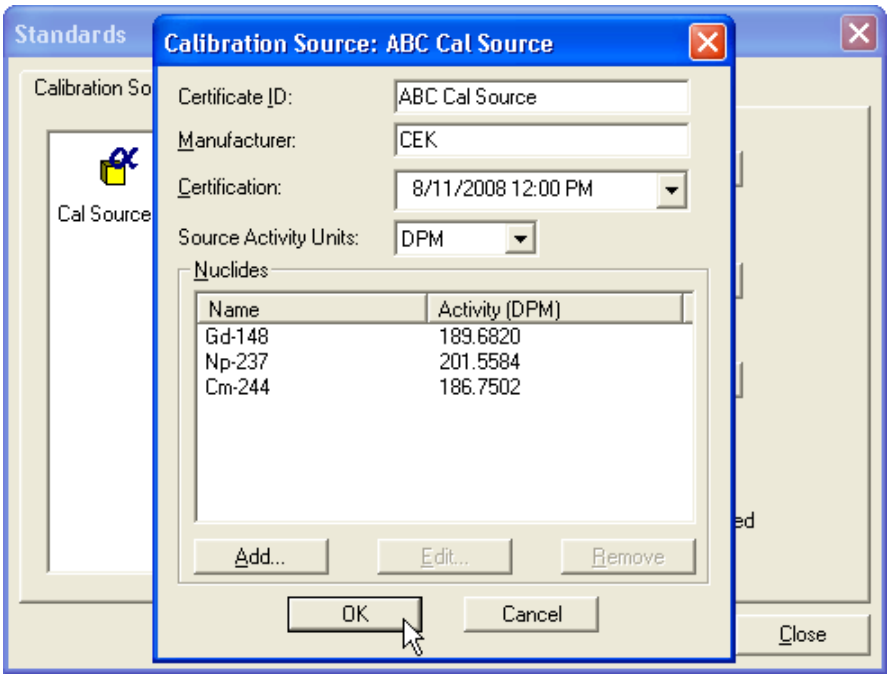


Fig. 82.

You are now ready to calibrate your detectors using the Calibration Wizard.

5.1.3.2. Calibrating the Detectors

Place your calibration source in the detector in the same geometry as your samples will be counted. Evacuate the chamber to the appro-priate pressure and you're ready to start your calibration count. In this example, you'll learn how to calibrate a single detector using the Calibration Wizard.

1. To begin your count, select **Process/ Calibration** from the menu bar. This will open the first screen of the AlphaVision v5.6 Calibration Wizard, General (Fig. 83). This screen allows you to name the calibration and, if you wish, create a template to use for future calibrations.

   Type a descriptive **Name** for the calibration and for a **Template**. You may choose also to type a **Description**. This description is stored in the database for use in reports and assists other users in understanding the intended use of this template. Click on **Next** to advance to the Acquisition wizard page.

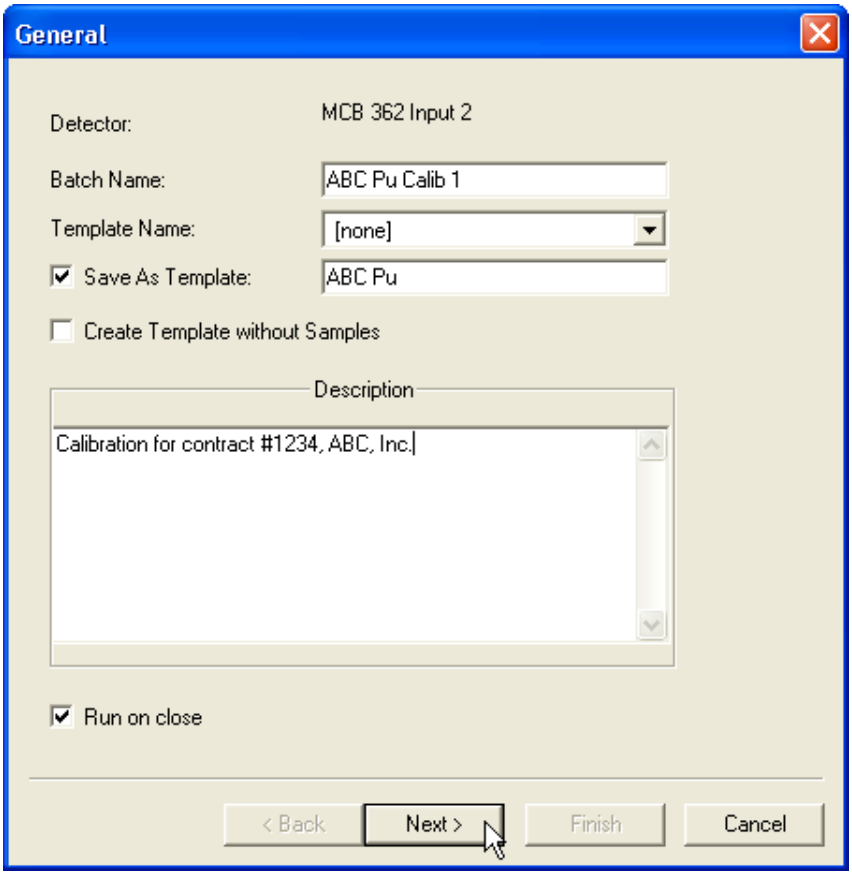


Fig. 83.

2. On the Acquisition page (Fig. 84), the **Live Time** checkbox should already be marked and active (if it isn't marked, click on it). Enter the **Live Time** for your calibration. You may also elect to use the pressure and leakage current **Thresholds**. If you mark the **Thresholds** checkbox and enter maximum vacuum (**Max Vacuum**), minimum bias (**Min Bias**), and maximum leakage current (**Max Leakage** I) values, AlphaVision will suspend counting if one or both of the thresholds are exceeded. When these parameters fall below the threshold, counting will automatically resume. In this exercise we are using a **Max Vacuum** of 30 Torr, a **Min Bias** of 45 V, and a **Max Leakage I** of 1000 nA.

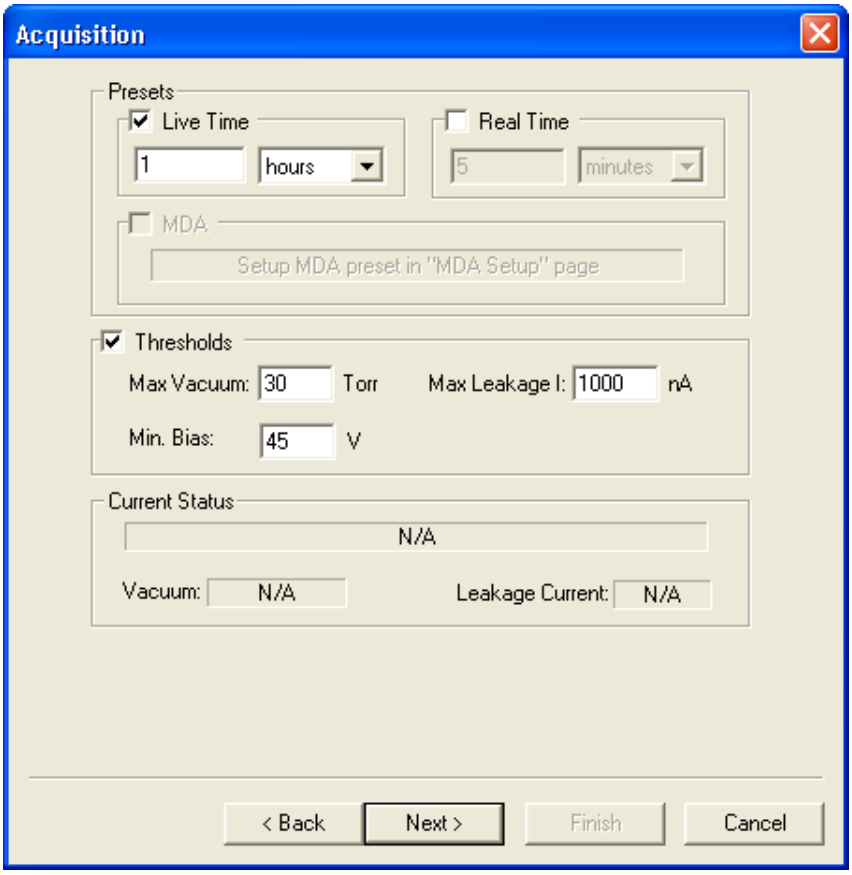


Fig. 84.

NOTE The upper limit of the chamber-pressure sensor is 30 Torr in OCTETE-series instruments and 65 Torr in the OASIS. Use 30 Torr so the count will pause if a chamber is not being pumped. A **Max Bias** setting of 45 V ensures that a detector bias of 50 V is maintained (note, however, that there is some variability in detector bias). Use 1000 nA as the maximum leakage current that signifies detector "failure." Alternatively, you might want to test the leakage current for your detectors, take the average, then use twice that value as the **Max Leakage I** threshold.

Click on **Next** to advance to the Energy/Efficiency Calibration Setup page.

3. On the Energy/Efficiency Calibration Setup page (Fig. 85), you will set up the analysis method for your calibration. First, you must select a **Standard Source** to use for calibration. Click on **Select** to open the Standard Calibration Source dialog. Click on the *ABC Cal Source* that you created above (Fig. 86).

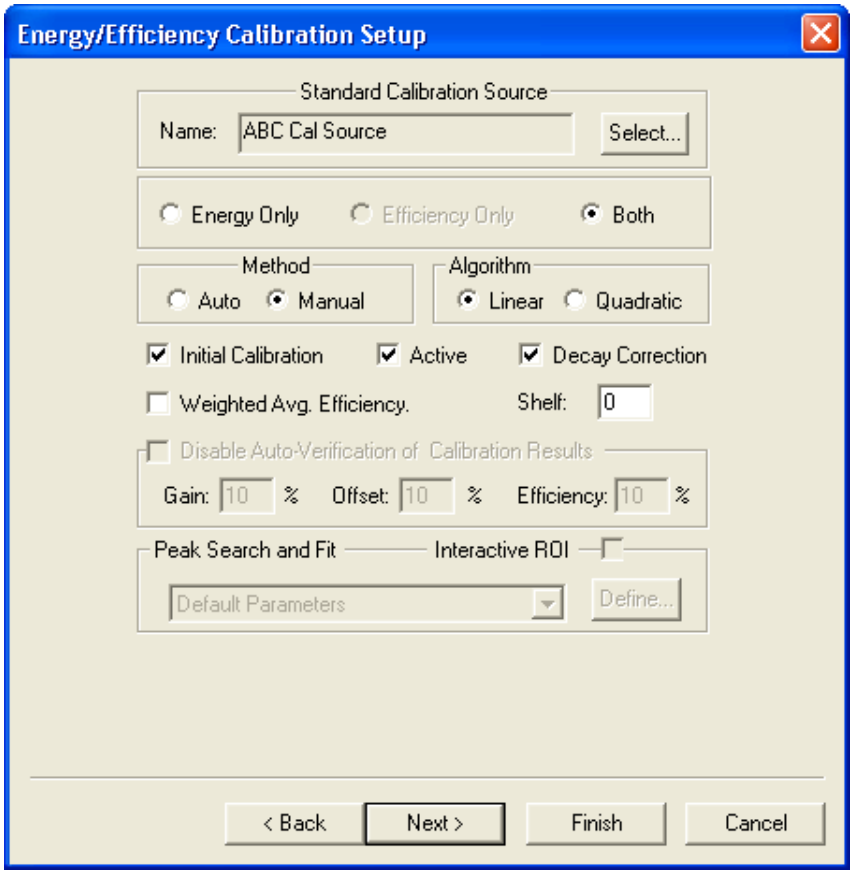


Fig. 85.

4. AlphaVision v5.6 allows you to calibrate using the **Auto** or **Manual** method. The **Auto** method uses the Peak Search and Fit parameters to integrate the peaks from the calibration source. The **Manual** method requires you to hand-select ROIs for efficiency calibration and peak energies for energy calibration. We'll use the **Manual** method for this exercise, so click on the Manual radio button. (Note that this disables the **Peak Search and Fit** section of the screen.)

5. Click the **Initial Calibration** radio button to inform AlphaVision that this is the calibration against which future calibrations for this detector will be compared — until another **Initial Calibration** is performed.

   (Note that when you select **Initial Calibration**, the calibration **Auto-Verification** tool is disabled. **Auto-Verification** allows you to automatically compare subsequent calibrations to the most recent **Initial Calibration** for the currently selected detector.

6. Enable the **Active** and **Decay Correction** features by clicking in the checkboxes provided (these should be set by default). The **Active** feature allows you to decide whether to use a particular calibration for QA purposes.

This feature enables you to run test calibrations of new sources (geometries or activities) without affecting your QA data, and saving these calibrations for future use. The **Decay Correction** feature simply decay corrects the Calibra-tion Source activity based on the **Certificate Date/Time** you entered when creating the Calibration Source record.

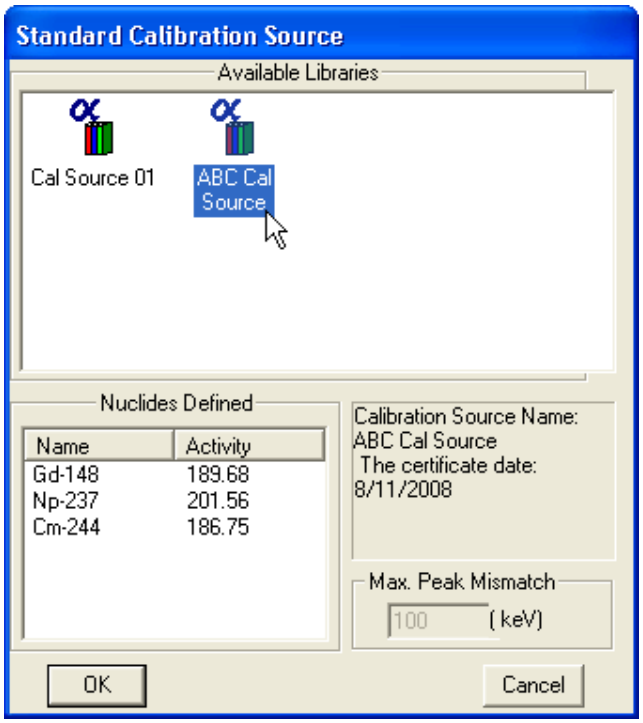


Fig. 86.

7. Click on the **Quadratic** radio button to include a quadratic term in the energy calibration.

8. Your next step in setting up the calibration (and in creating this calibration template for future reuse) is deciding how the average efficiency is to be calculated. AlphaVision v5.6 allows you to choose between a weighted average and a simple arithmetical average (mark or unmark the **Weighted Avg. Efficiency** checkbox). The weighted average weights the contribution to the average of each peak by the number of counts in the peak. In this example, the peak activities of the nuclides used are roughly equal so the difference between the weighted average and simple average will be small. Therefore, we will use the simple average by unmarking the **Weighted Avg. Efficiency** box.

9. The **Shelf** feature enables you to distinguish calibrations by shelf position in the alpha chamber. For this example, enter a "1" in the **Shelf** field to indicate that the source is being counted with the planchet holder in the uppermost shelf. The **Shelf** column in the Calibration Explorer will display the number you enter here so you can easily tell which calibration to use for different shelf positions. This means that you can have multiple calibrations for a single detector.

   Note that the default calibration for an analysis is always *the most recent active calibration performed* for the detector the sample is counted with. If you decide to count a sample in a different shelf position, the Batch Wizard allows you to choose another calibration prior to analysis by selecting from the **Calibration Set** droplist on the Analysis Setup screen (see Fig. 144 on page 121).

   You have now completed setting up the calibration parameters. Click on **Next** to continue to the Report page.

10. Use the features on the Report page (Fig. 87) if you wish to automatically print the analysis results and/or export them to other file formats or custom report templates. (You can also do this from the Report Window.) In this case, click on **Print on Completion**.

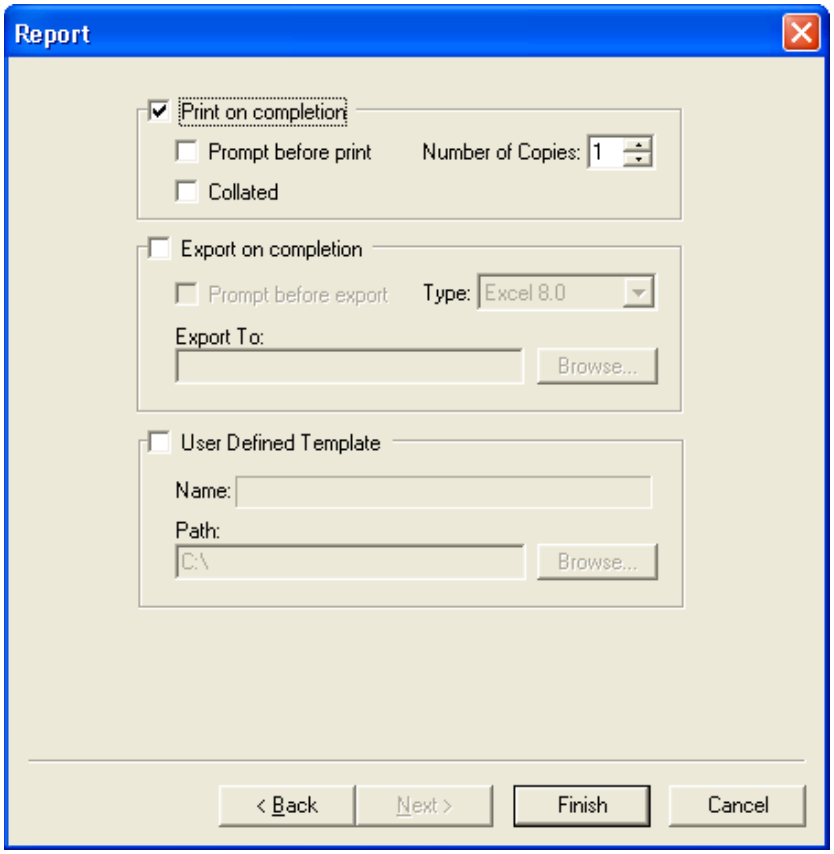


Fig. 87.

11. Click **Finish** to begin counting your calibration source. The live spectrum will be displayed in the Spectrum Window during acquisition. You can also observe the count in progress using the **MCA View** command, which opens MAESTRO in an independent window. To use this feature, go to the Detector Grid, right-click on the icon for the detector counting your source, and choose **MCA View** from the right-mouse-button menu. **MCA View** allows you to view the detector hardware directly, set ROIs, view the acquisition presets, print ROI reports, etc., without changing data in the AlphaVision database or interrupting the count in progress. However, **MCA View** does not allow you to stop or clear a count that was started from within Alpha-Vision v5.6 — this protects you from accidentally clearing the detector memory and losing spectrum data.

12. When the count is complete, the Manual Energy and Efficiency dialog will open (Fig. 88). In this window, you will use the calibration source data to calibrate your detector, however, you will be able to change these data to match your spectrum more precisely if you wish. You may find it useful to move the dialog away from the Spectrum Window (click and drag

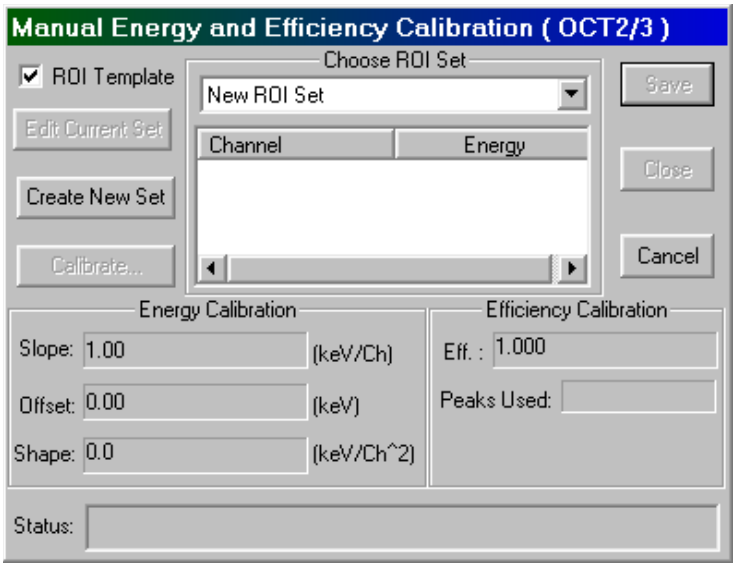


Fig. 88.

by the dialog's title bar). The accompanying illustration shows the AlphaVision screen and the Manual Energy and Efficiency dialog arranged as you might see them during a typical calibration (Fig. 89).

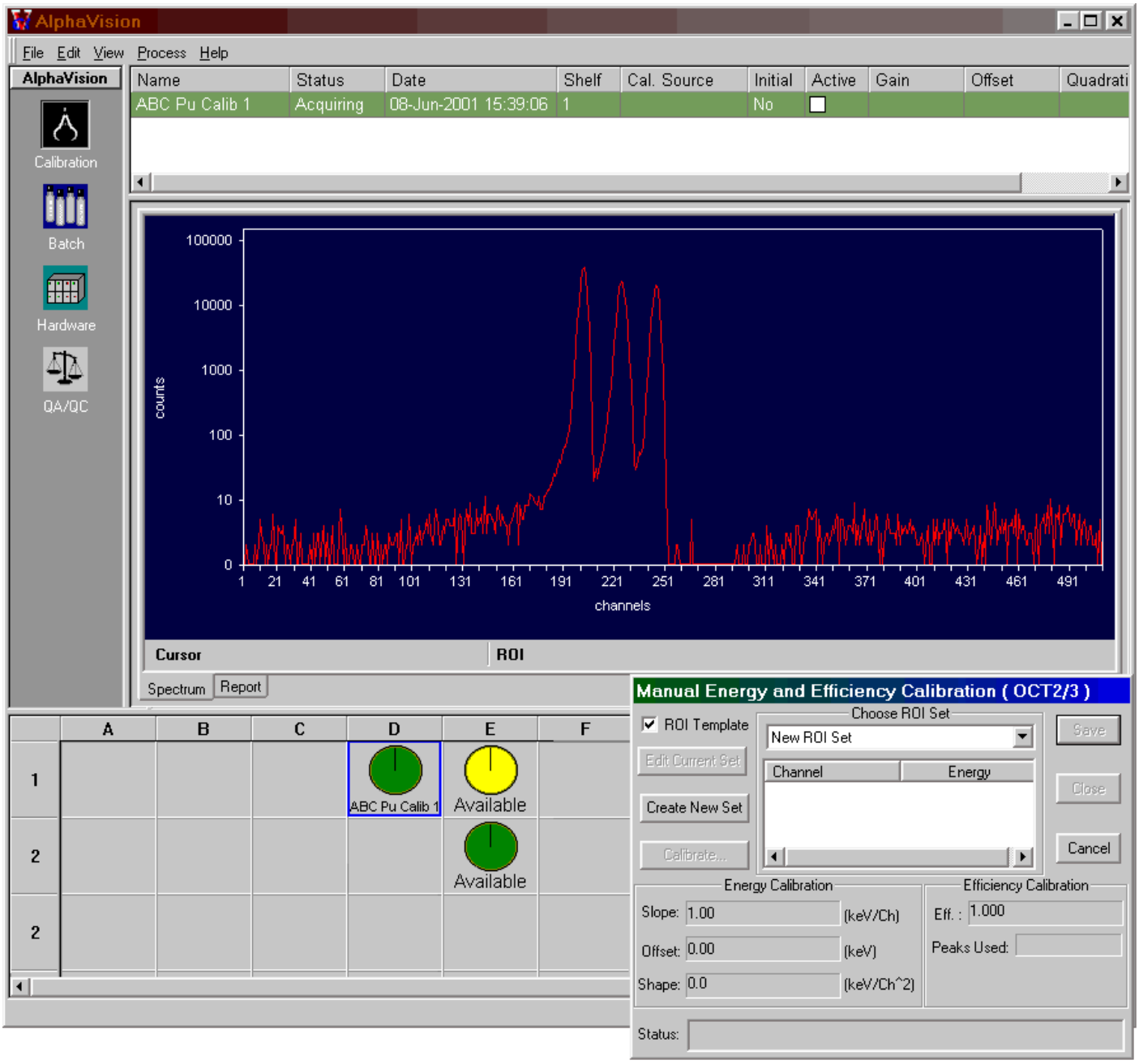


Fig. 89.

13. ***Creating an ROI Set for This Calibration Record***
    The next step is to set the ROIs for the analysis by creating a type of database record called an **ROI Set**. The ROI Editor gives you two ways to enter the ROI **Low** (start) and **High**

(end) channels interactively in conjunction with the mouse and Spectrum Window, and manually from the keyboard. We will use the interactive method.

a. To create an **ROI Set**, go to the calibration dialog and click on **Create New Set**. This will open the ROI Editor (Fig. 90). Note the **Define ROIs in Energy (keV)** checkbox in the upper right corner of the dialog. Except in Calibration mode, AlphaVision v5.6 now allows you to define ROI Sets either in channels or energy (keV) by marking this box. In Calibration mode, ROI Sets are always expressed in channels.

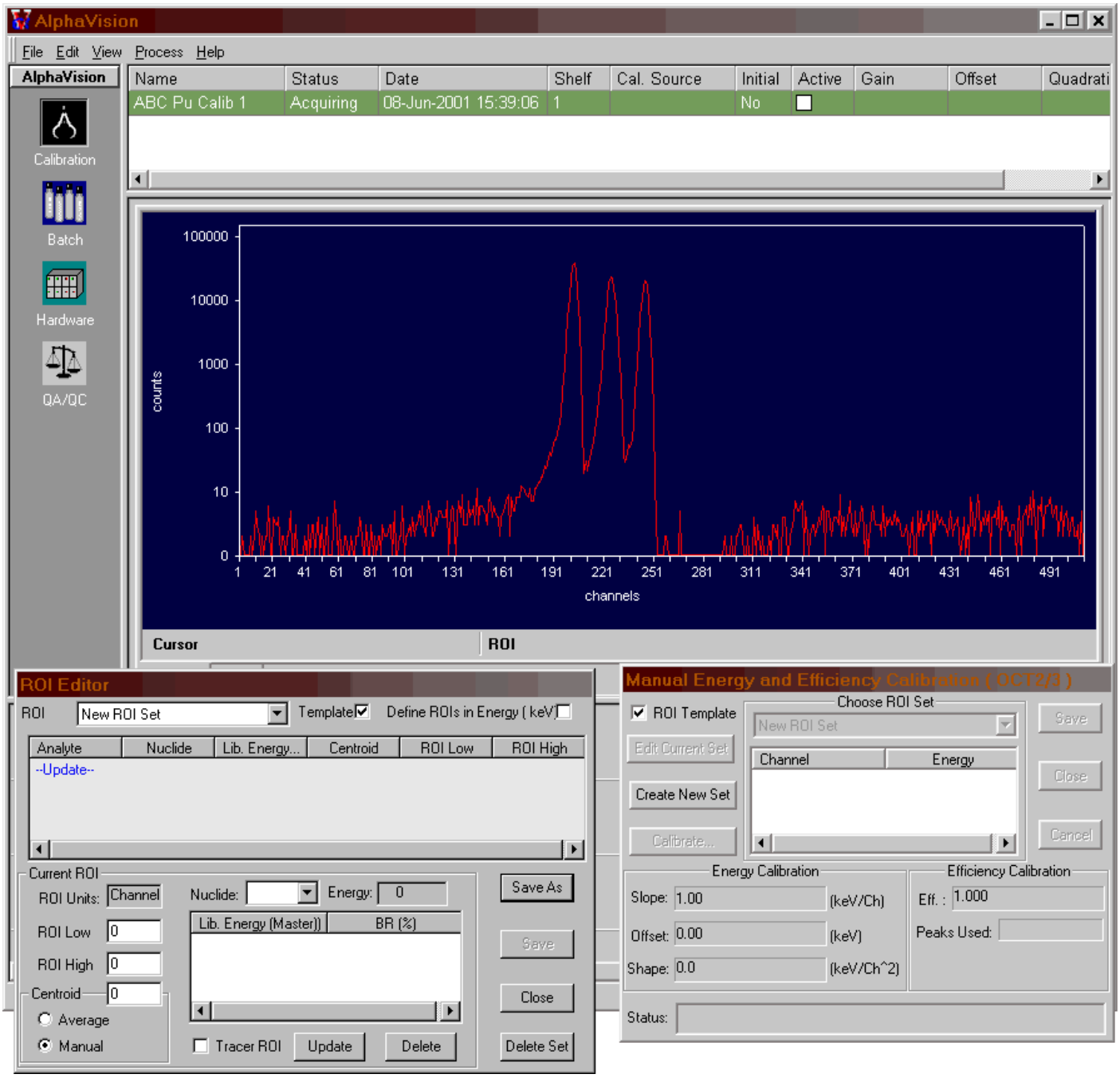


Fig. 90.

b. Next you'll need to set the limits for each of the 3 ROIs by designating a **Low** channel, **High** channel, and **Centroid** for each peak. To determine the precise channels, you'll need to zoom in on the 3 peaks. In this example, we will zoom in using the Thumbnail window, however, you can also click and drag a rubber rectangle around the area of interest, then right-click, and select **Zoom In** from the right-mouse-button menu.

To open the Thumbnail window, right-click in the Spectrum Window and choose **Show Thumbnail** from the right-mouse-button menu (Fig. 91). Figure 92 shows the AlphaVision screen, calibration dialog, ROI Editor, and Thumbnail arranged as you might see them during a typical calibration.

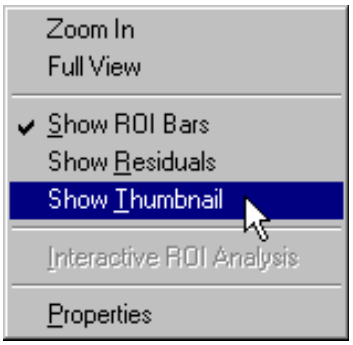


Fig. 91.

To zoom in, go to the Thumbnail window and click and drag the mouse diagonally across the 3 peaks; this will draw a rubber rectangle around the area you wish to see in more detail. Release the left mouse button. The main Spectrum Window will adjust the scale to show the peaks you enclosed in the rubber rectangle, and the Thumbnail will highlight the zoomed section of spectrum, as shown in Fig. 93. You are now ready to define the ROIs.

c. In the ROI Editor, go to the ROI list and click on the ***-Update-*** entry. This prepares AlphaVision to read the ROI start and end channels from the position of the mouse in the Spectrum Window, as explained in the next step.

d. In the Spectrum Window, locate the lowest-energy peak that you will be using in this set. In our example that will be ^{148}Gd. Hold down the **<Ctrl>** key, left-click on the low-channel end of the ROI, drag the mouse to the high-channel end, then release the mouse button and the **<Ctrl>** key. The **Low** and **High** channels (in this example, 179 and 210, respectively) will be automatically entered in the ROI Editor (Fig. 94).

e. Next, use the mouse to manually mark the peak **Centroid**. In the Spectrum Window, locate the peak centroid and click once on it. The channel you click will automatically be entered in the **Centroid** field (Fig. 95); in this example, the centroid is at channel 203. (If you miss the channel you intended, click again as often as you wish until you are satisfied with the position you have selected, or you can enter it from the keyboard.)

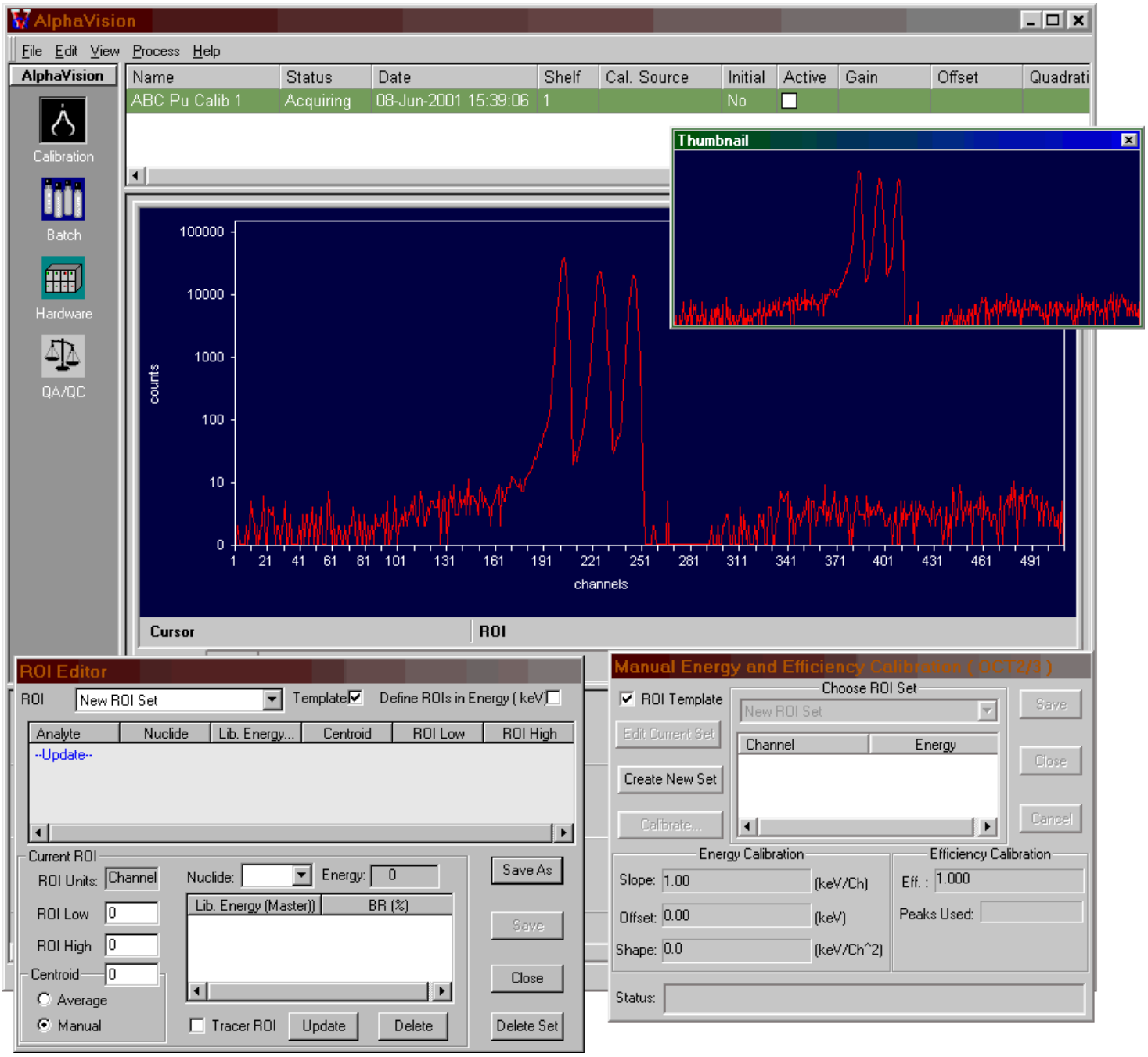

AlphaVision
File Edit View Process Help
AlphaVision
Calibration
Batch
Hardware
QA/QC
Name Status Date Shelf Cal. Source Initial Active Gain Offset Quadrati
ABC Pu Calib 1 Acquiring 08-Jun-2001 15:39:06 1 No
Thumbnail
counts
channels
Cursor
ROI
ROI Editor
ROI New ROI Set Template Define ROIs in Energy (keV)
Analyte Nuclide Lib. Energy... Centroid ROI Low ROI High
--Update--
Current ROI
ROI Units: Channel
ROI Low 0
ROI High 0
Centroid 0
Average
Manual
Nuclide: Energy: 0
Lib. Energy (Master) BR (%)
Tracer ROI Update Delete
Save As Save Close Delete Set
Manual Energy and Efficiency Calibration (OCT2/3)
ROI Template
Edit Current Set
Create New Set
Calibrate...
Choose ROI Set
New ROI Set
Channel Energy
Save Close Cancel
Energy Calibration
Slope: 1.00 (keV/Ch)
Offset: 0.00 (keV)
Shape: 0.0 (keV/Ch^2)
Efficiency Calibration
Eff. : 1.000
Peaks Used:
Status:

Fig. 92.

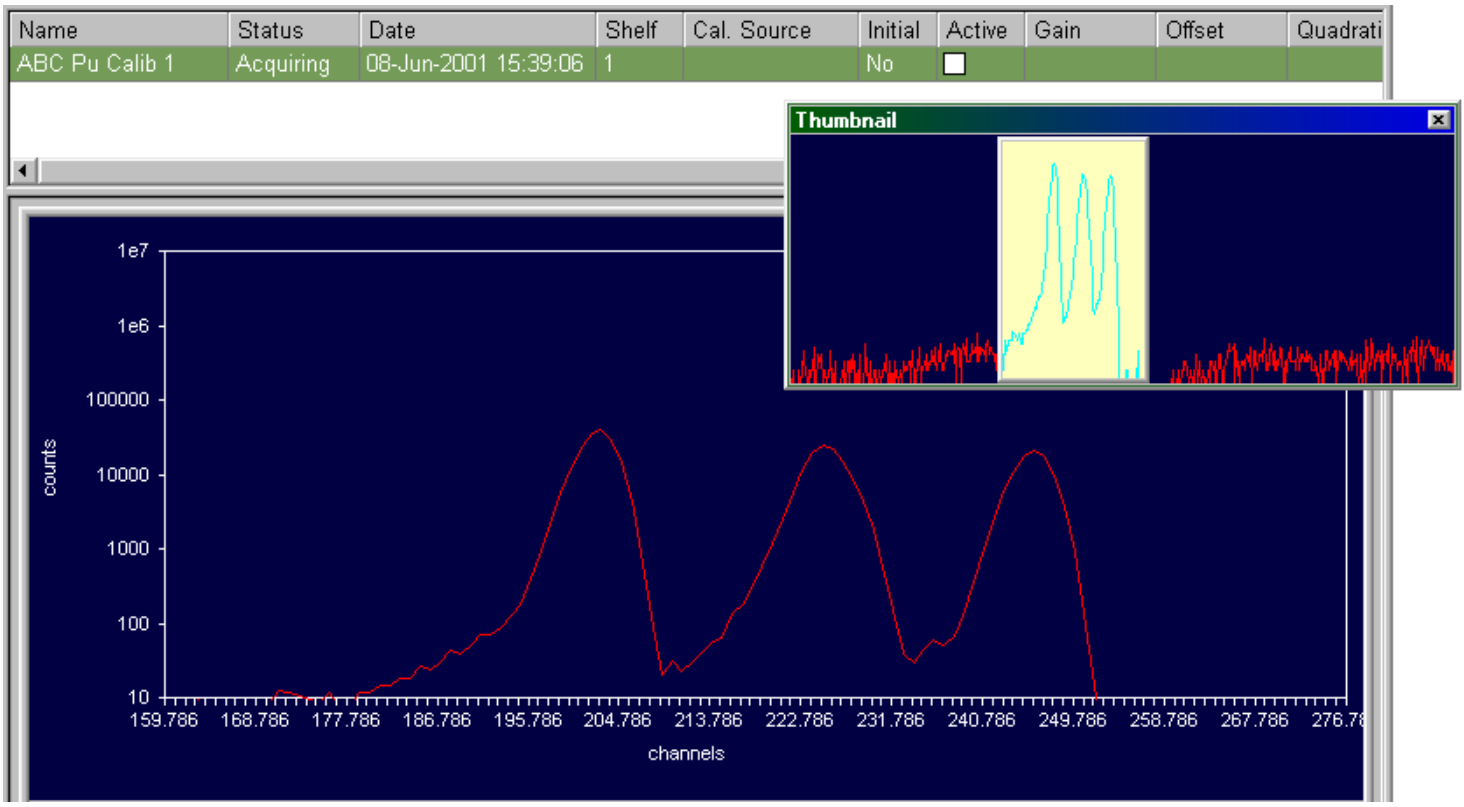

Name
Status
Date
Shelf
Cal. Source
Initial
Active
Gain
Offset
Quadrati
ABC Pu Calib 1
Acquiring
08-Jun-2001 15:39:06
1
No
Thumbnail
1e7
1e6
100000
10000
1000
100
10
counts
159.786
168.786
177.786
186.786
195.786
204.786
213.786
222.786
231.786
240.786
249.786
258.786
267.786
channels

Fig. 93.

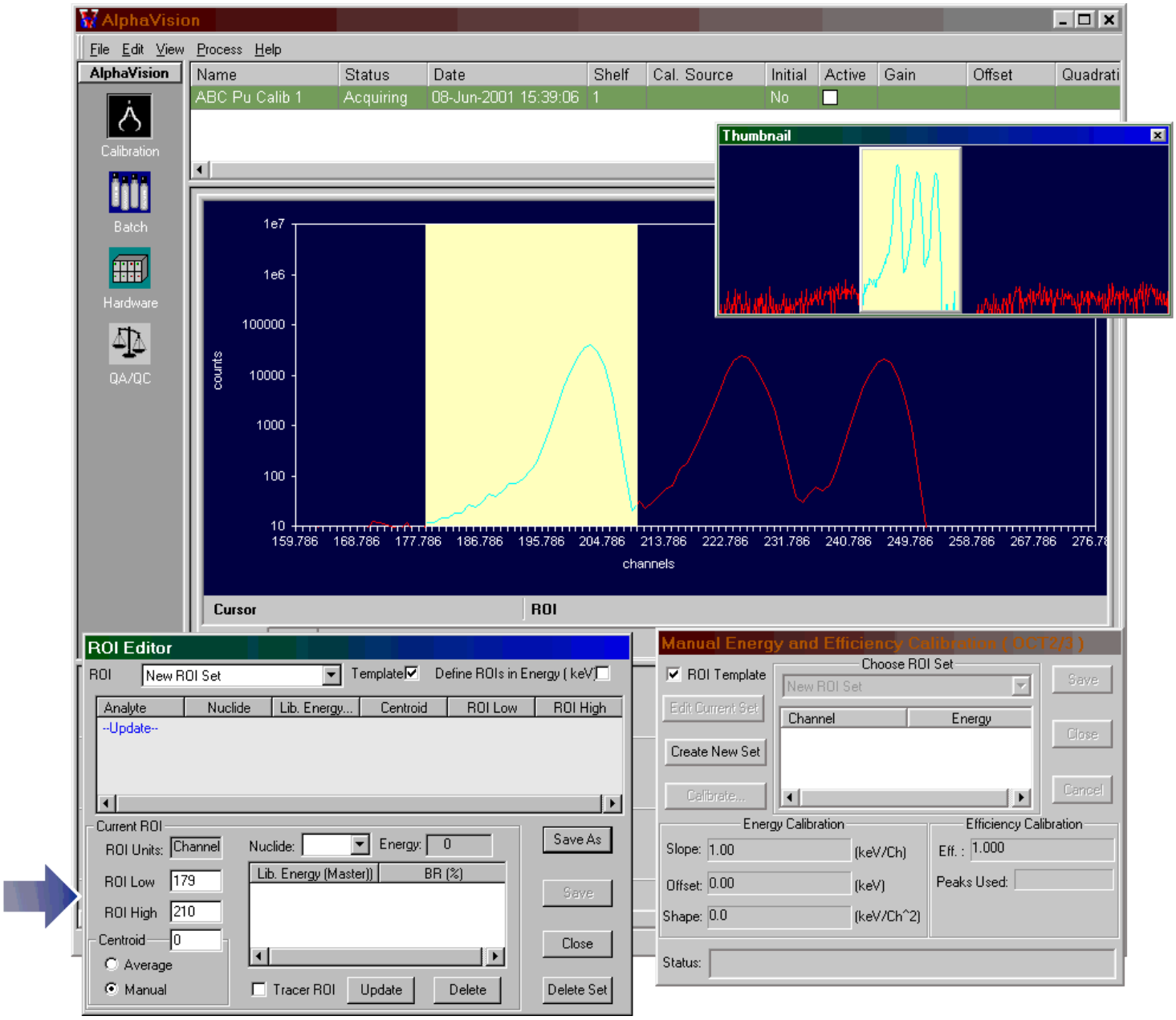

AlphaVision
File Edit View Process Help
AlphaVision
Calibration
Batch
Hardware
QA/QC
Name Status Date Shelf Cal. Source Initial Active Gain Offset Quadrati
ABC Pu Calib 1 Acquiring 08-Jun-2001 15:39:06 1 No
Thumbnail
counts
channels
Cursor
ROI
ROI Editor
ROI New ROI Set Template Define ROIs in Energy (keV)
Analyte Nuclide Lib. Energy... Centroid ROI Low ROI High
--Update--
Current ROI
ROI Units: Channel
ROI Low 179
ROI High 210
Centroid 0
Average
Manual
Nuclide: Energy: 0
Lib. Energy (Master)) BR (%)
Tracer ROI Update Delete
Save As
Save
Close
Delete Set
Manual Energy and Efficiency Calibration (OCT2/3)
ROI Template
Edit Current Set
Create New Set
Calibrate...
Choose ROI Set
New ROI Set
Channel Energy
Save
Close
Cancel
Energy Calibration
Slope: 1.00 (keV/Ch)
Offset: 0.00 (keV)
Shape: 0.0 (keV/Ch^2)
Efficiency Calibration
Eff. : 1.000
Peaks Used:
Status:

Fig. 94.

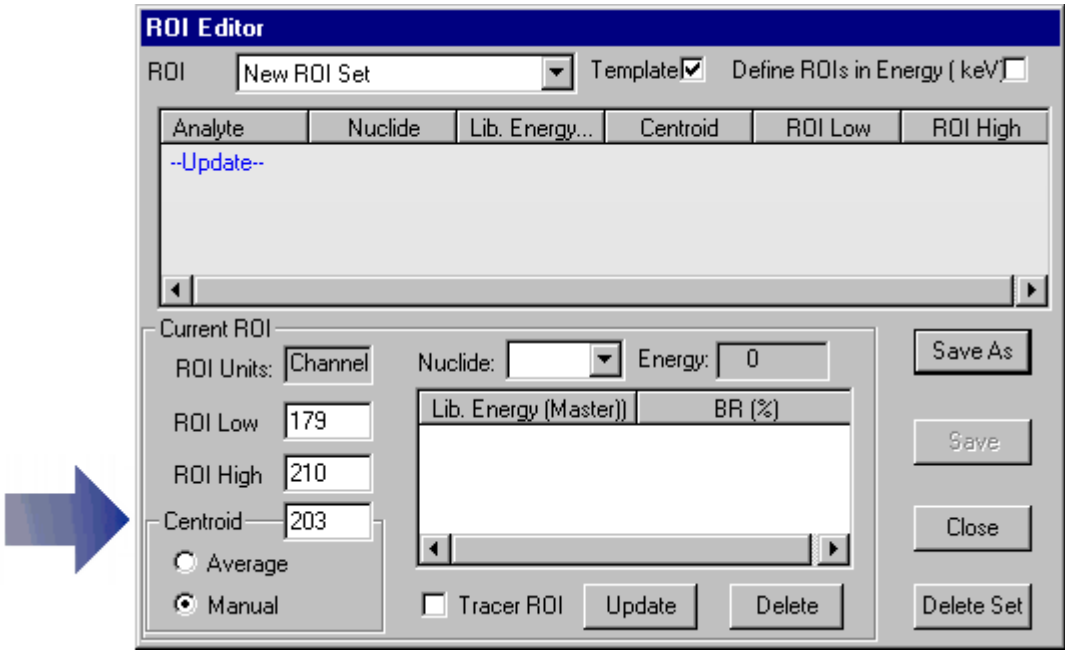


Fig. 95.

f. In the ROI Editor, click on the **Nuclide** droplist and choose ^{148}Gd (Fig. 96).

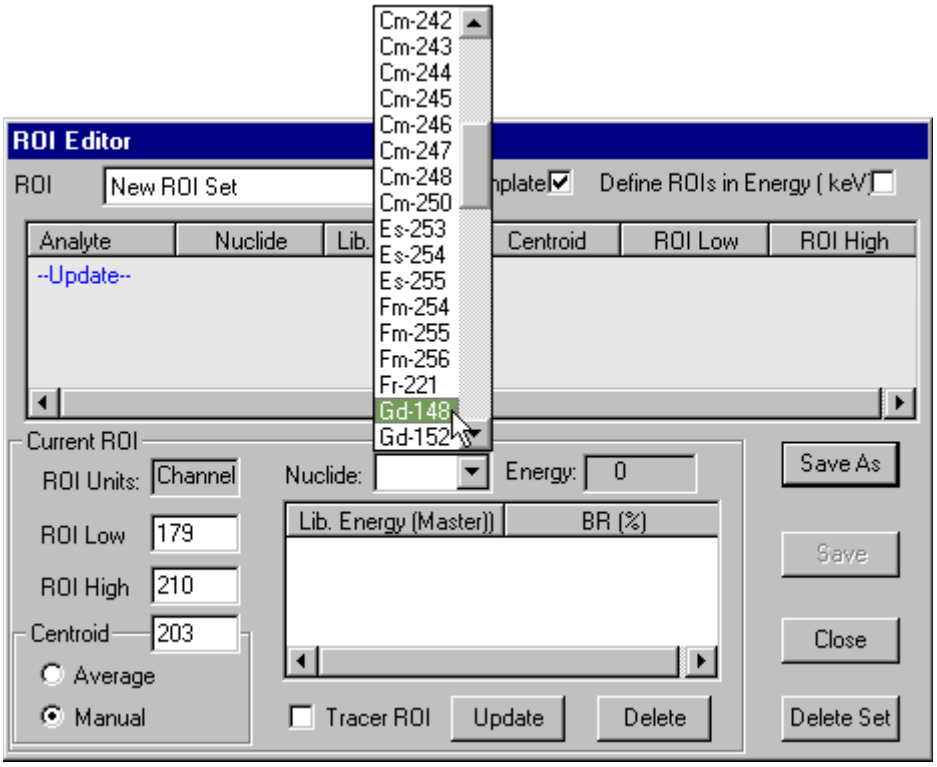


Fig. 96.

g. Finally, click on **Update** (Fig. 97). The values you just selected will now be displayed in the main section of the ROI Editor (Fig. 98). You have successfully created the ROI for ^{148}Gd.

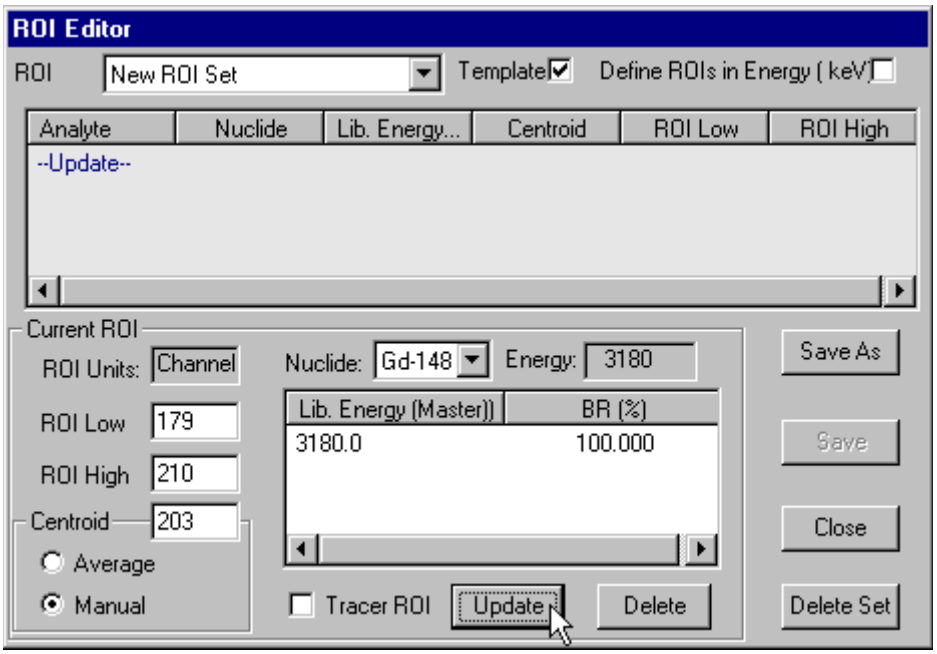


Fig. 97.

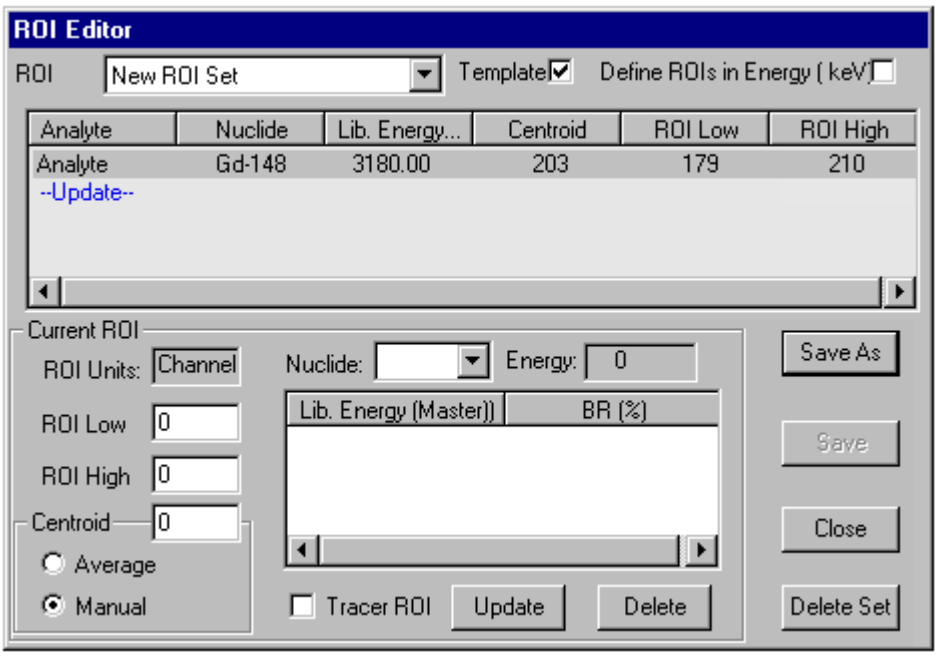


Fig. 98.

h. Repeat this procedure for ^{244}Cm and ^{237}Np (Fig. 99).

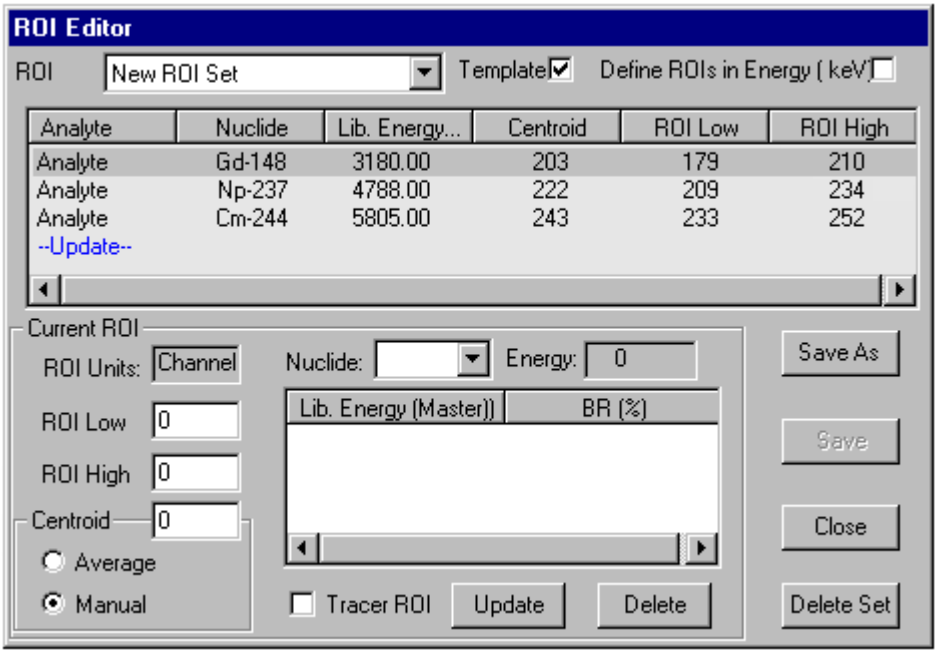


Fig. 99.

i. Your new **ROI Set** is now ready to use. Click on **Save**, assign it a **New Name**, and click on **OK** to return to the Manual Energy and Efficiency Calibration dialog (Fig. 100). AlphaVision will automatically load the contents of the new ROI Set into the calibration dialog.

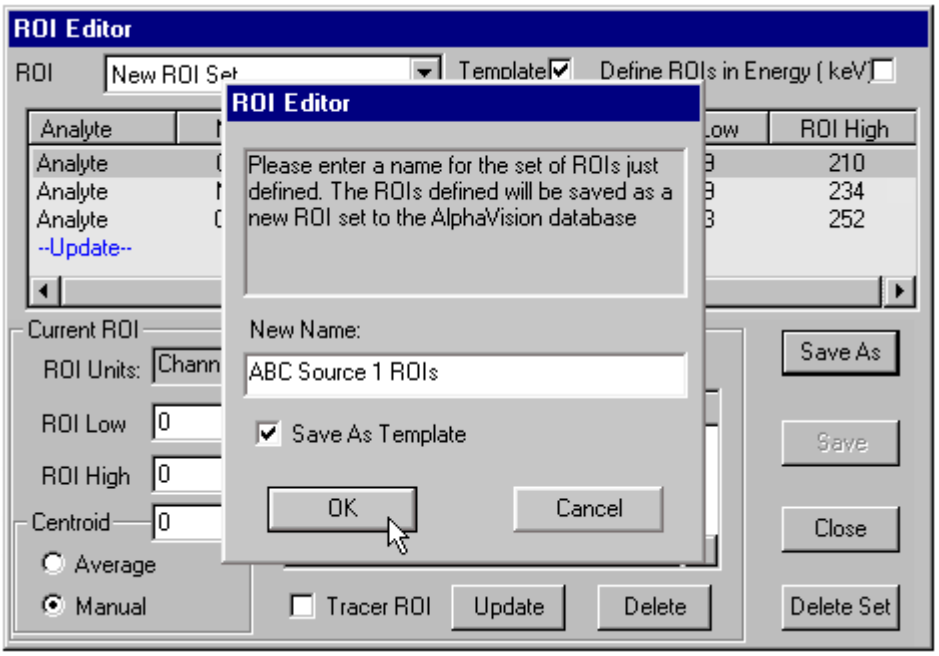


Fig. 100.

14. In the calibration dialog, click on **Calibrate** (Fig. 101). AlphaVision will calculate and display the efficiency and energy calibration factors, including a **Status** note at the bottom of the calibration dialog (which, in Fig. 102, reads **Calibration completed**). Always check this status line when you click on **Calibrate**. In addition, monitor the AlphaVision Event Window for error messages pertaining to this calibration.

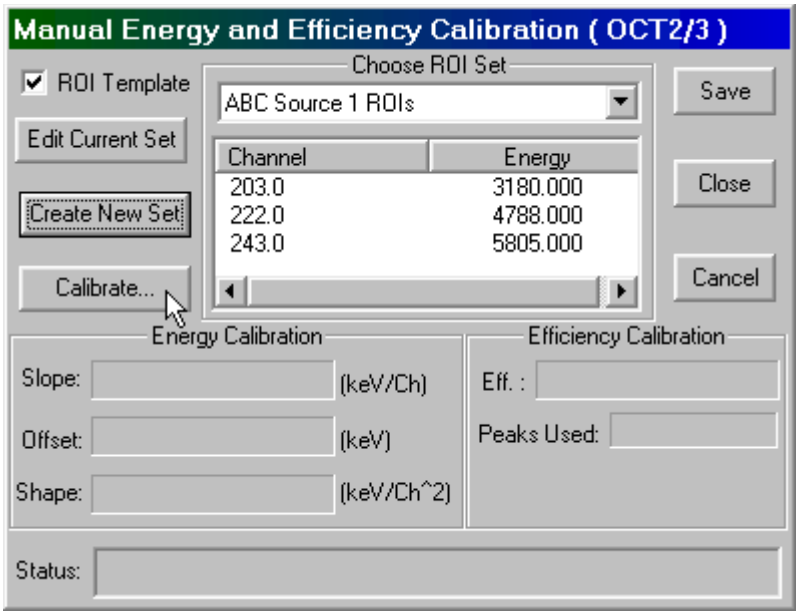


Fig. 101.

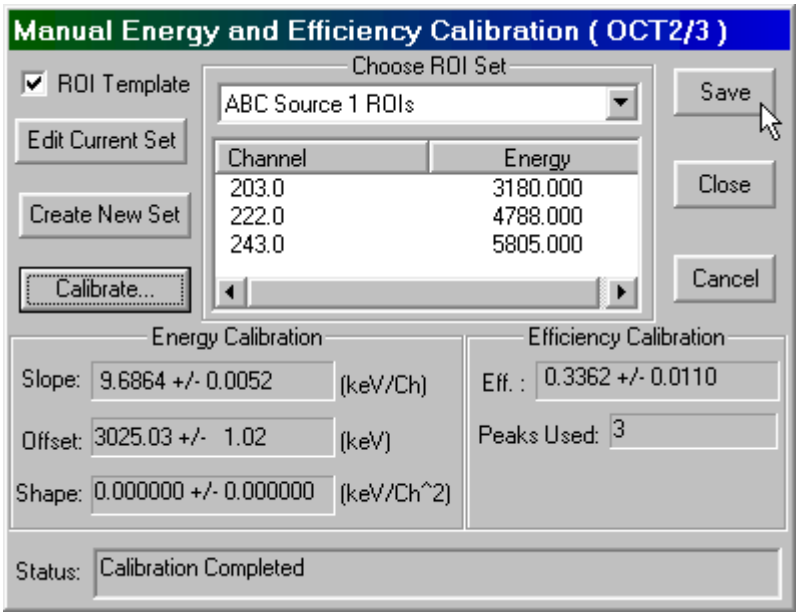


Fig. 102.

Note that in **Manual** calibrations, AlphaVision v5.6 allows you to inspect and modify the calibration data before committing them to the database. This enables you to adjust the ROIs if you made an error in selecting peak channels or ROI limits.

15. Click on **Save** to save the calibration to the database. Click on **Close** to return to the main AlphaVision screen.

16. The parameters for this **Completed** calibration are displayed in the upper Calibration Explorer Panel above the Spectrum/Report Window (Fig. 103).

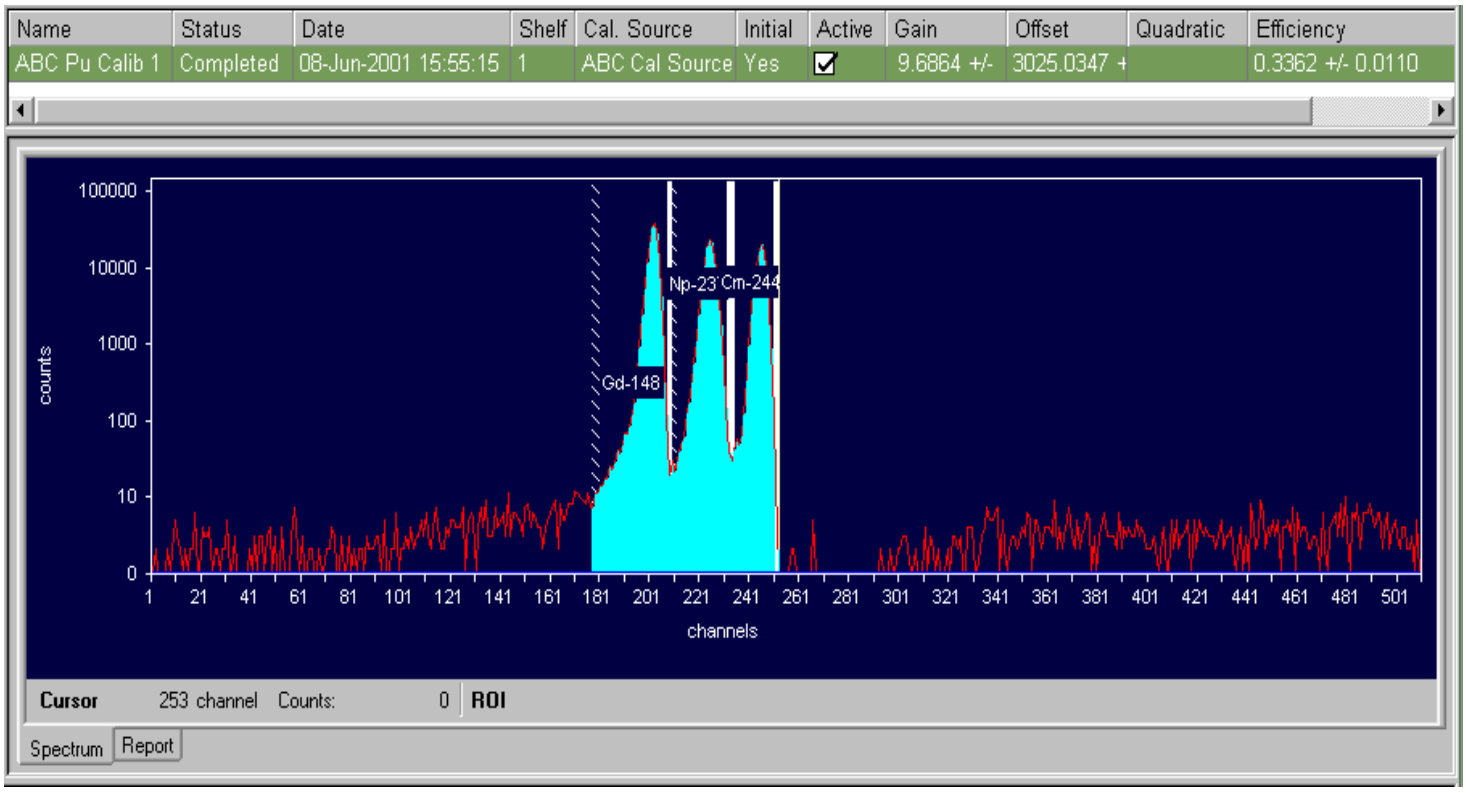


Fig. 103.

And that's it! You are now ready to begin creating the next set of records you'll need for processing sample batches.

5.1.4. Step 3 — Before Batching: Creating Libraries, QA Types, and Tracer Sets

The next step in using AlphaVision v5.6 is to prepare the Tracer Set and Control Solution data records the software needs in order to track the quality of sample preparation and hardware conditions.

Before you create these data records, you'll need to prepare the corresponding solutions in your wet-chemistry laboratory. A tracer is a solution standard used to calculate the chemical recovery

for your samples (^{242}Pu is used in our example). A control solution is a standard solution consisting of the analyte/nuclide of interest (^{239}Pu is used in our example). In general, these standard solutions are prepared by diluting standard reference materials obtained from NIST (or some other reference laboratory or source manufacturer) or purchased in diluted form directly from the source manufacturer. In either case, you'll need to input some information about these standards into AlphaVision before counting samples. AlphaVision makes this simple and straightforward to do.

5.1.4.1. Creating a QA Control Solution

AlphaVision v5.6 allows you to create a control solution for a particular element and vary the volume added from batch to batch — the software tracks the recovery regardless of the volume added.

1. Go to the menu bar and click on **Edit/Standards**. This will open the Standards dialog.

2. To create a control solution record, click on the Control Solutions tab and choose **Add** (Fig. 104). The Control Solution dialog will open (Fig. 105).

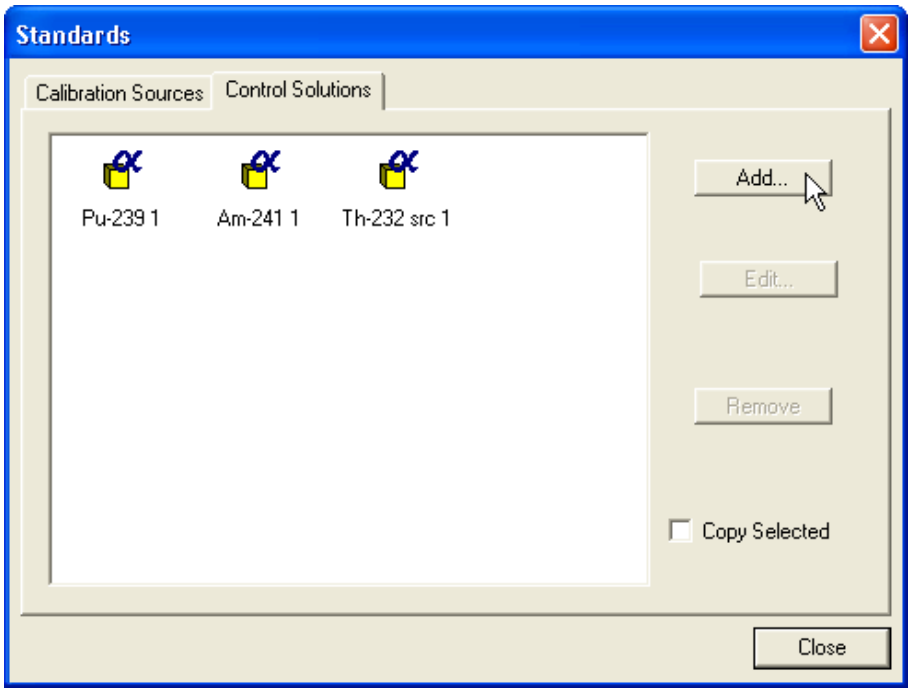


Fig. 104.

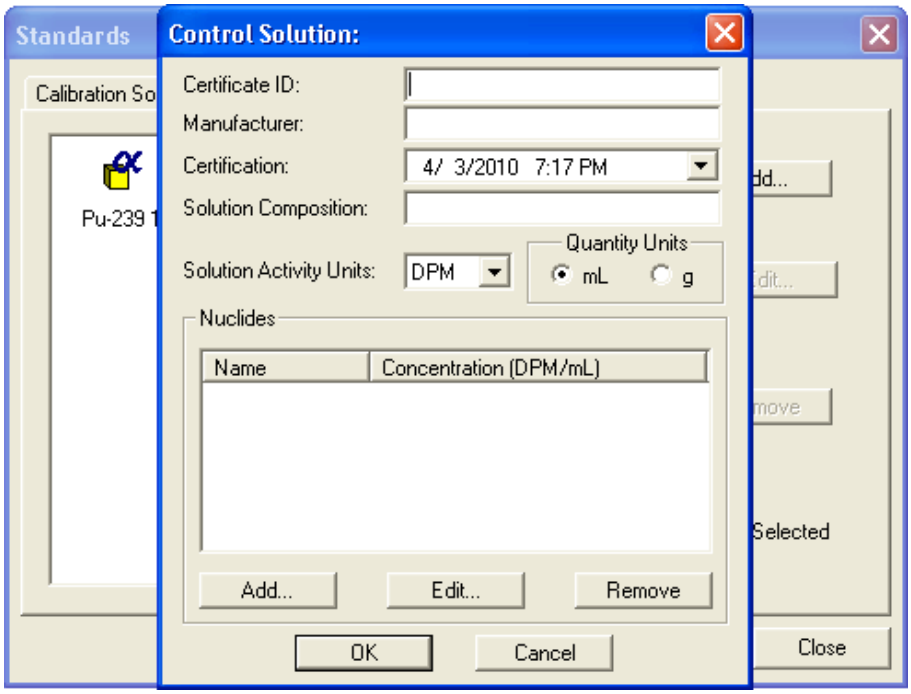


Fig. 105.

3. Enter the name of the control solution (**Certificate ID**), **Manufacturer** (whether in-house or vendor), a note about the **Solution Composition**; and a **Certification** date/time using the Date Tool (Fig. 106).

   The **Certificate** date is used to decay correct the activity of each of the nuclides contained in the Control solution. Typically, control solutions contain only one nuclide, however, but you may wish to include more; e.g., ^{241}Am and ^{244}Cm can be included for Am/Cm analyses. If you use more than one nuclide, you will need to decay correct the activity of each nuclide to a common date and time, which you should then use as the **Certificate** date/time for this record. This will give AlphaVision v5.6 a single date on which to base its decay corrections. In this example, we use one nuclide, ^{239}Pu, for our control solution, which we have named *ABC Pu-239 Control* (Fig. 107).

   Finally, select from the **Solution Activity Units** droplist, and choose **mL** or **g** for the **Quantity Units**. The resulting activity-per-volume units will be displayed beside the **Activity** field on the Nuclide Information dialog (Fig. 108).

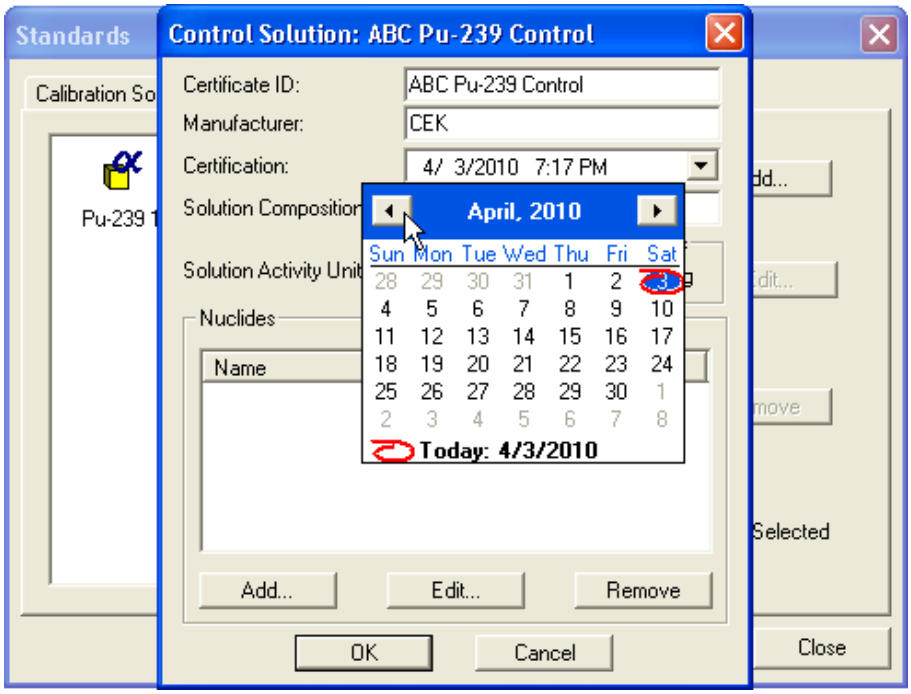


Fig. 106.

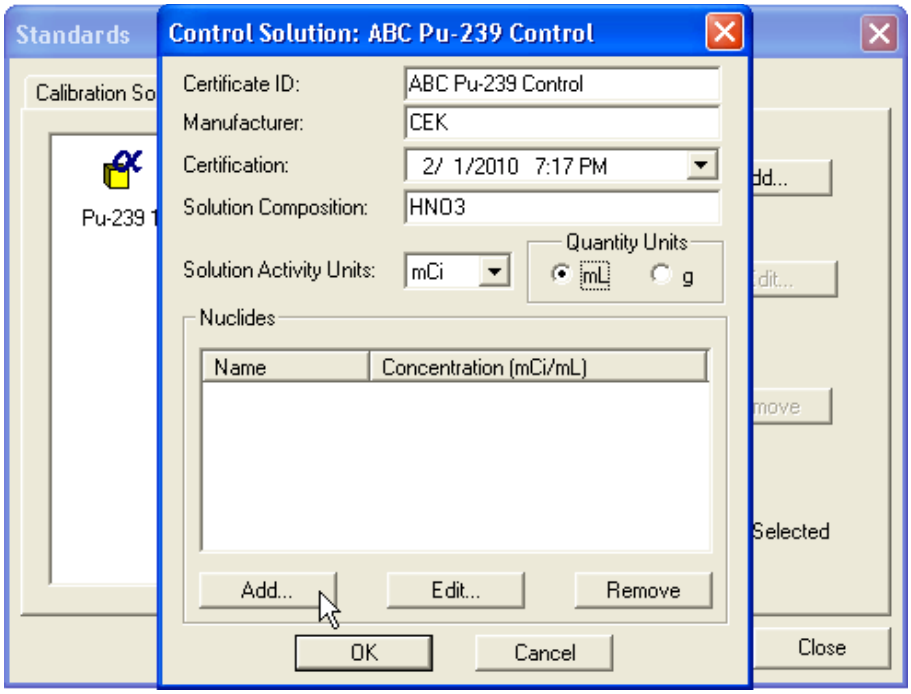


Fig. 107.

4. To add a nuclide to the Control Solution record, click on **Add** to open the Nuclide Information dialog (Fig. 108). Select ^{239}Pu from the **Nuclide** droplist, and enter its certified **Activity** in the selected activity-per-volume units.

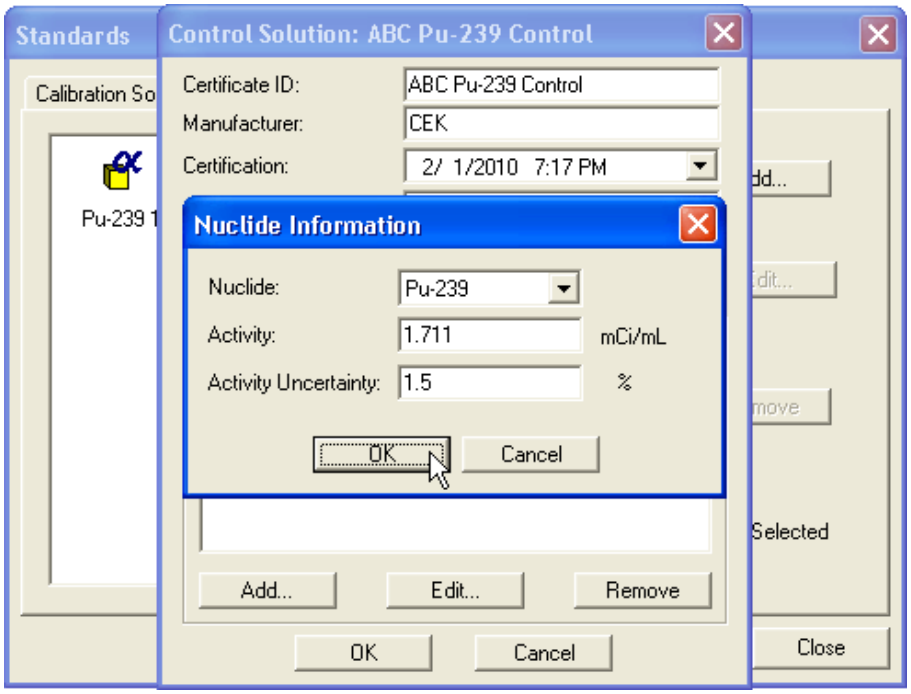


Fig. 108.

If you wish, you can also enter the percent **Activity Uncertainty** associated with the diluted standard (Fig. 109). This user-defined uncertainty is at the one-sigma level (and is normally based on the uncertainty associated with the preparation of the diluted standard and the stated uncertainty on the standard certificate). Click on **OK**.

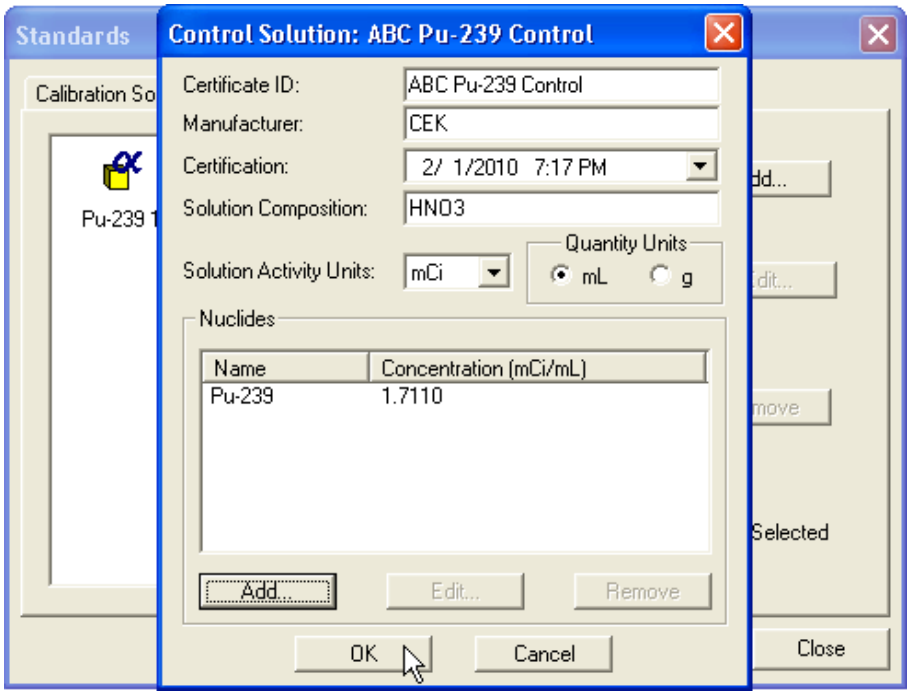


Fig. 109.

5. To modify your entry, click on the nuclide, click on **Edit**, make the necessary changes, and click on **OK.**

6. Once you have entered the activity and uncertainty for all the nuclides in your standard source, click on **OK** to return to the Standards dialog (Fig. 110), then click on **Close** to return to the main AlphaVision screen.

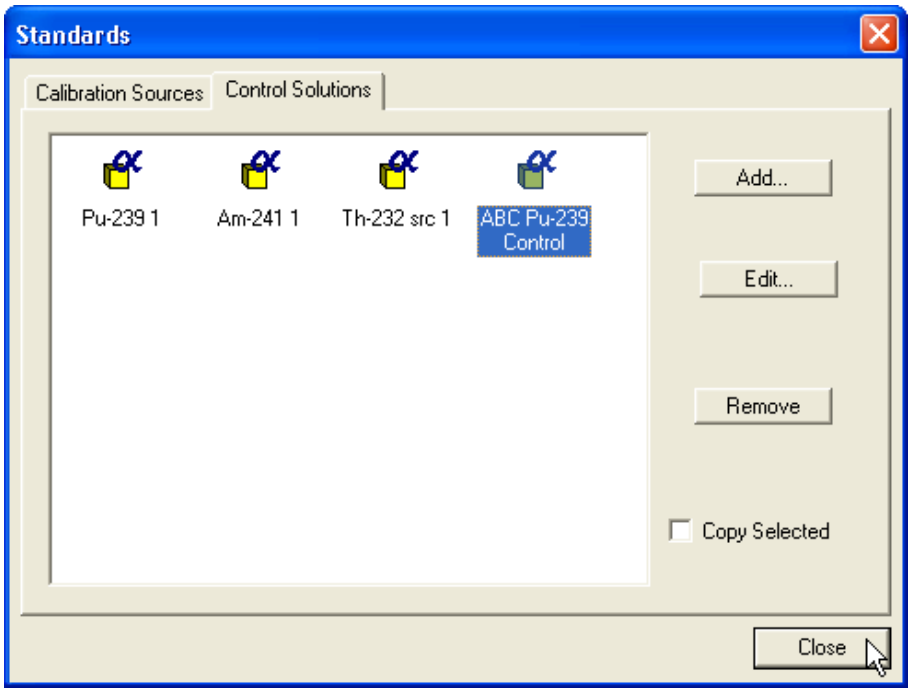


Fig. 110.

5.1.4.2. Creating a Nuclide Library

A nuclide library is simply a list of nuclides used for an analysis. AlphaVision v5.6 analysis libraries are created in the Nuclide Library Editor (**Edit/Nuclide Libraries...**). These libraries are drawn from AlphaVision's Master Nuclide List of alpha-emitting nuclides. All library entries include the nuclide name, half-life, alpha-particle peak energies, and branching ratios. In an analysis, AlphaVision sums the branching ratios of the peaks that are contained within the energy limits of the peak region — whether (1) a user-defined ROI from an ROI Set or (2) a software- derived region from a Peak Search and Fit analysis. For routine analyses, we recommend that you create a nuclide library for each element of interest. Since the AlphaVision v5.6 peak search algorithm finds the energy in the library that is closest to an identified peak, the more nuclide-specific your libraries are, the less chance there is of incorrectly identifying a peak.

AlphaVision 4 users note: AlphaVision v5.6 sums branching ratios automatically. For calculating activities, there is no need to edit the branching ratios contained in the master library.

In this example, we'll create a library for Pu analyses named *ABC Pu Library*.

1. Go to the menu bar and click on **Edit/Nuclide Libraries...**. This will open the Nuclide Libraries dialog (Fig. 111).

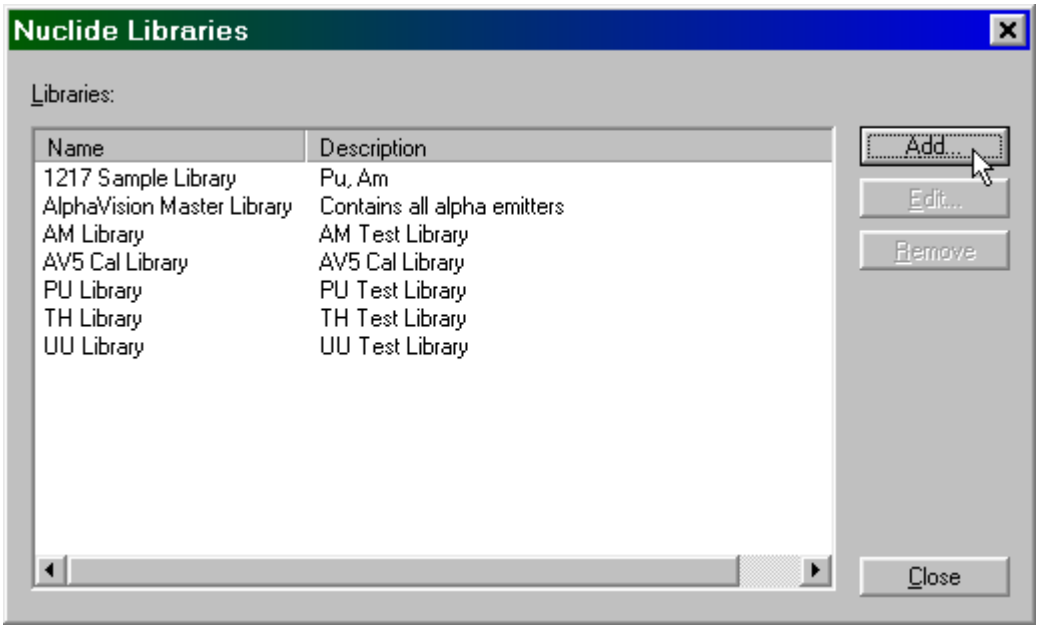


Fig. 111.

2. Click on **Add...** to open the Nuclide Library dialog (Fig. 112).

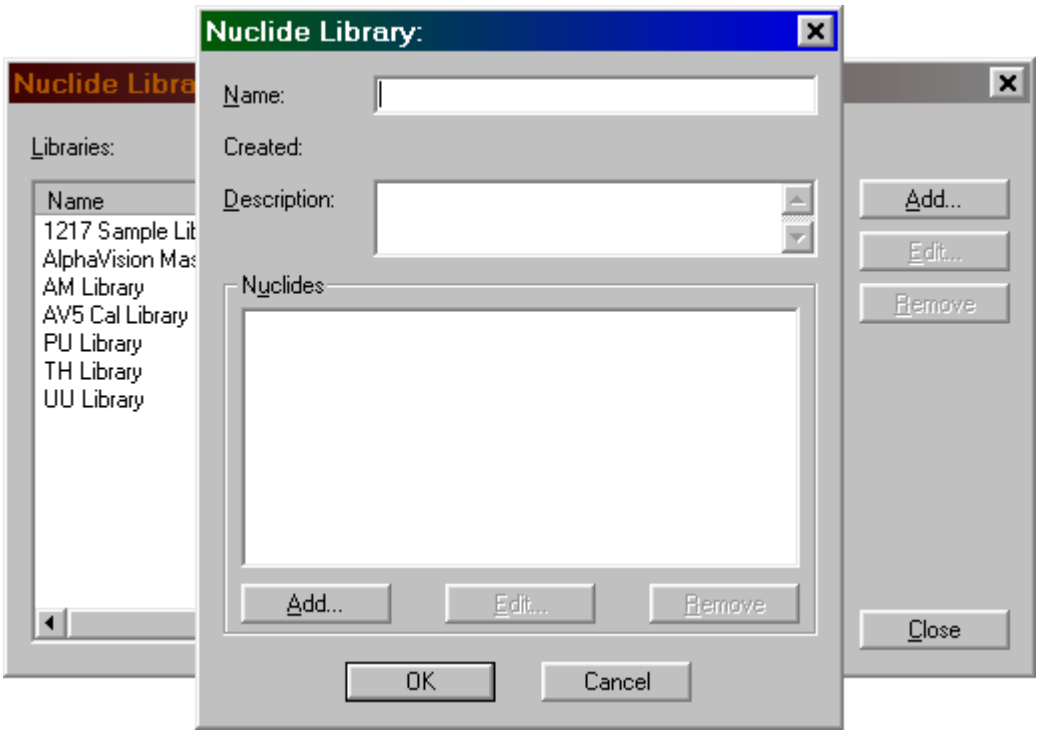


Fig. 112.

3. Enter a **Name** — *ABC Pu Library* — and **Description** for the new library. (The read-only **Created** field shows the library's creation date/time, which is assigned by AlphaVision when you complete the library.) You may wish to enter a **Description** that further describes the use of the library (Fig. 113).

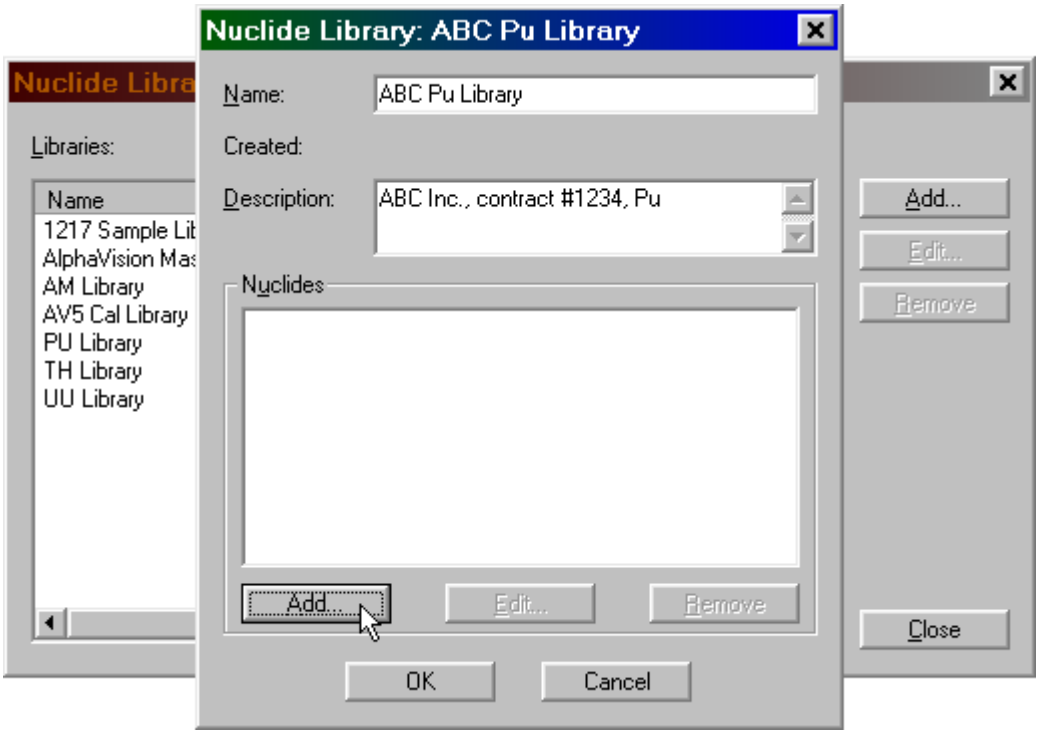


Fig. 113.

4. To add one or more nuclides to the library, click on **Add...**. This will open the Select Nuclide dialog. To add a single nuclide, click on the desired one then click on **OK.** To add more than one nuclide at the same time, hold down the **<Ctrl>** key and click on each of the desired nuclides, then click on **OK.** All highlighted nuclides will be copied into the Nuclides list on the Nuclide Library dialog. To add a contiguous block of nuclides, click on the first nuclide in the block, hold down the **<Shift>** key, click on the final nuclide in the block, then click on **OK.** Figure 114 shows the block selection of all 5 Pu isotopes at once. Click on **OK** to return to the Nuclide Library dialog (Fig. 115).

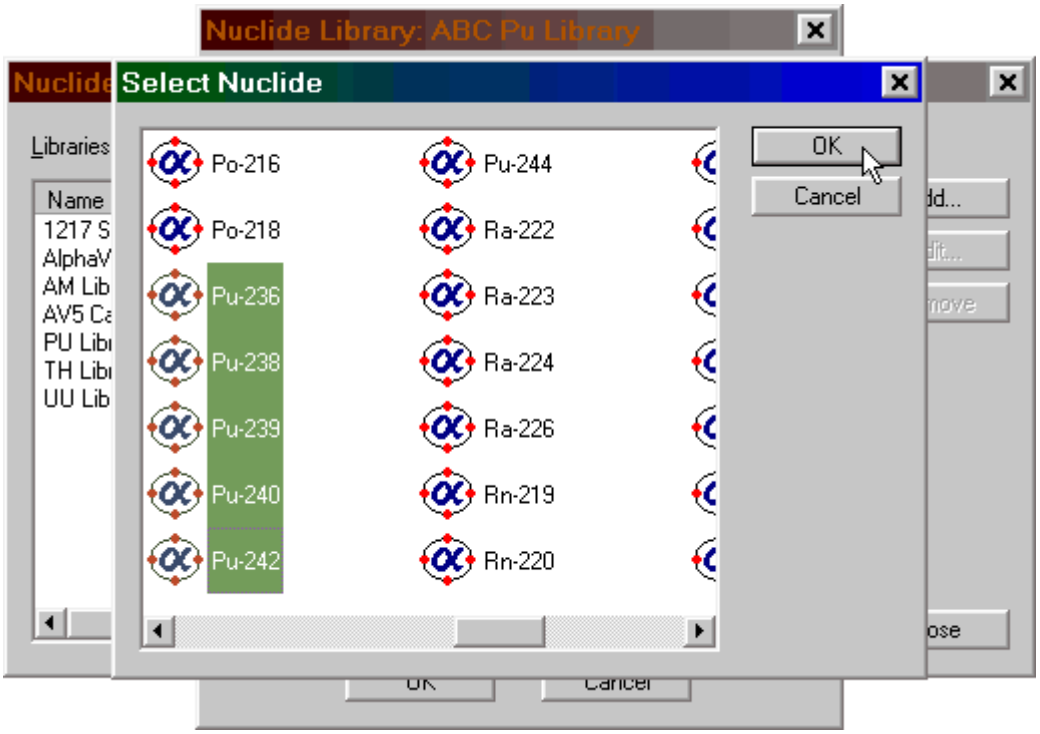


Fig. 114.

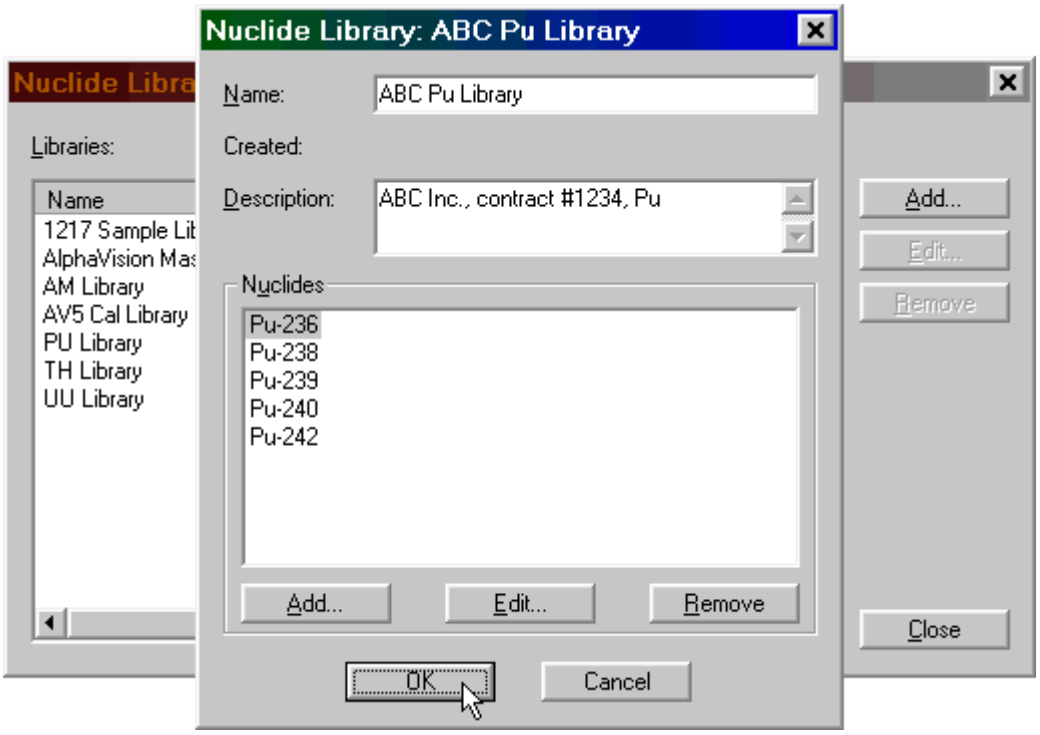


Fig. 115.

5. To remove a nuclide from the library, click on it then click on **Remove**. (You can also edit peak energies and half-lives for each nuclide if you wish.)

6. To complete library setup, click on **OK** to return to the Nuclide Libraries dialog (Fig. 116), then click on **Close** to return to the main AlphaVision screen.

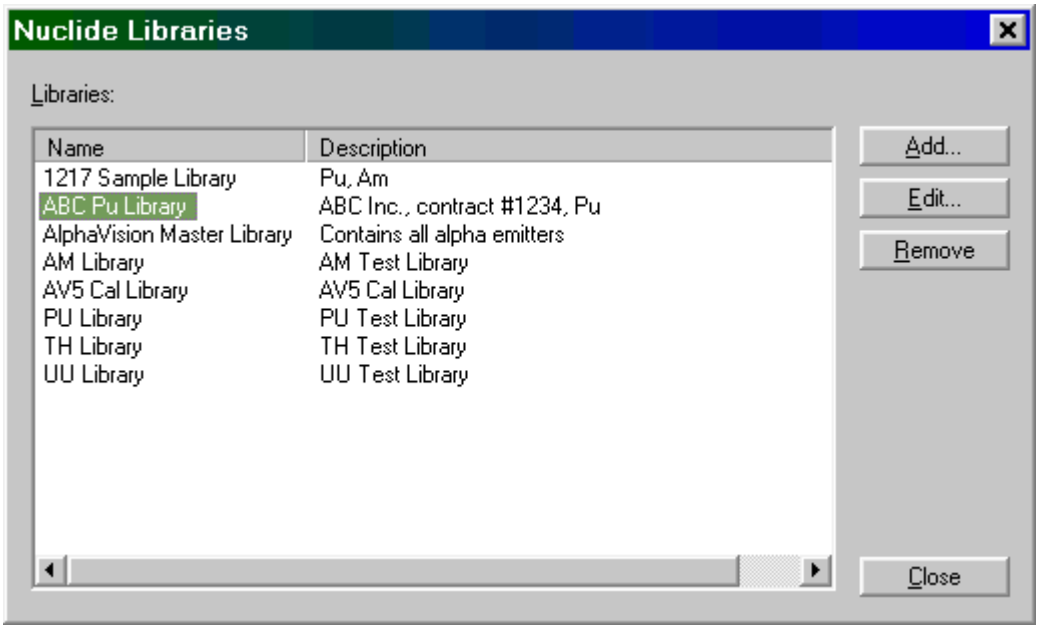


Fig. 116.

5.1.4.3. Creating a Tracer Record

The tracer nuclide is typically an isotope of one of the analytes, and emits an alpha that is energetically distinct from the analytes (for example, if a client is look-ing for ^{239}Pu/^{240}Pu, ^{238}Pu, and ^{236}Pu, a typical tracer would be ^{242}Pu). The tracer is added to all samples in a batch, including the blank and the control. In this example, our Tracer Set will be called *ABC Pu242*.

1. On the menu bar, click on **Edit/Tracers...**. The Tracer Editor (Fig. 117) will open.

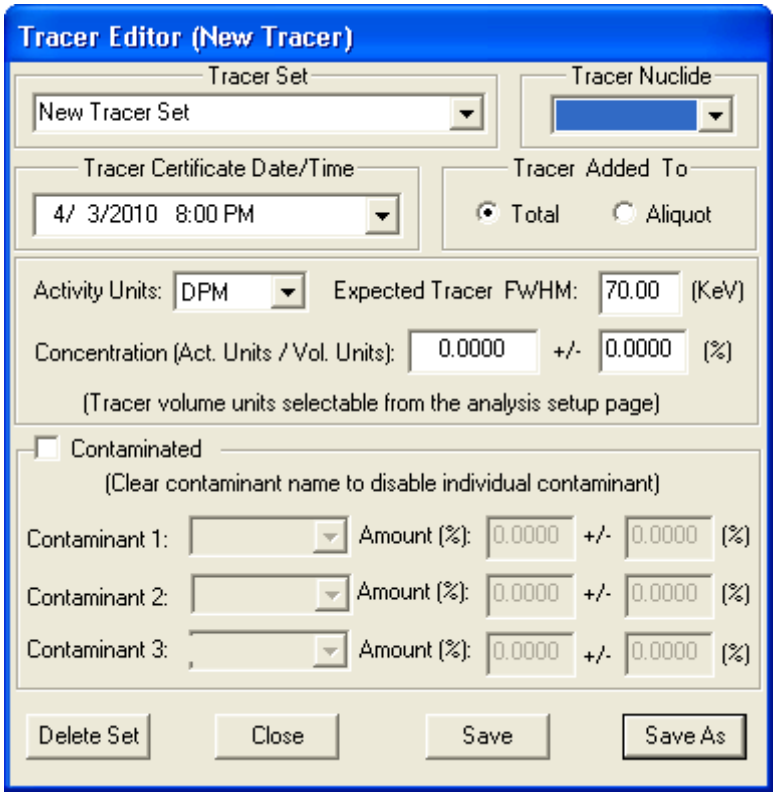


Fig. 117.

2. Click on the **Tracer Nuclide** droplist and select ^{242}Pu (Fig. 118).

3. Enter the **Tracer Certificate Date/ Time** in *dd/mm/yyyy hh:mm:ss* format using the date tool (Fig. 119). This date/time is used to decay-correct the tracer to the data acquisition start time.

4. Enter the tracer's certified **Activity Concentration**, and select the desired activity units/mL. If you wish, you can also associate a percent uncertainty (+/−); entered at a one-sigma level) with the activity of the tracer solution.

5. For laboratories that frequently add tracer to sample aliquots, you can choose between adding the tracer to **Aliquot** or **Total**. For this example, we'll use **Total**.

6. **Expected Tracer FWHM** is used for peak-search-and-fit and ROI analyses. It works in conjunction with **Adjust ROIs** in the Batch Wizard, and allows the software to adjust the width of analyte ROIs based on the width of the tracer peak. This reduces the number of adjustments you have to make to ROIs during the analysis process. The value entered here is used by the analysis algorithm as a starting point for this adjustment. For this example, we will use the default setting of 70 keV.

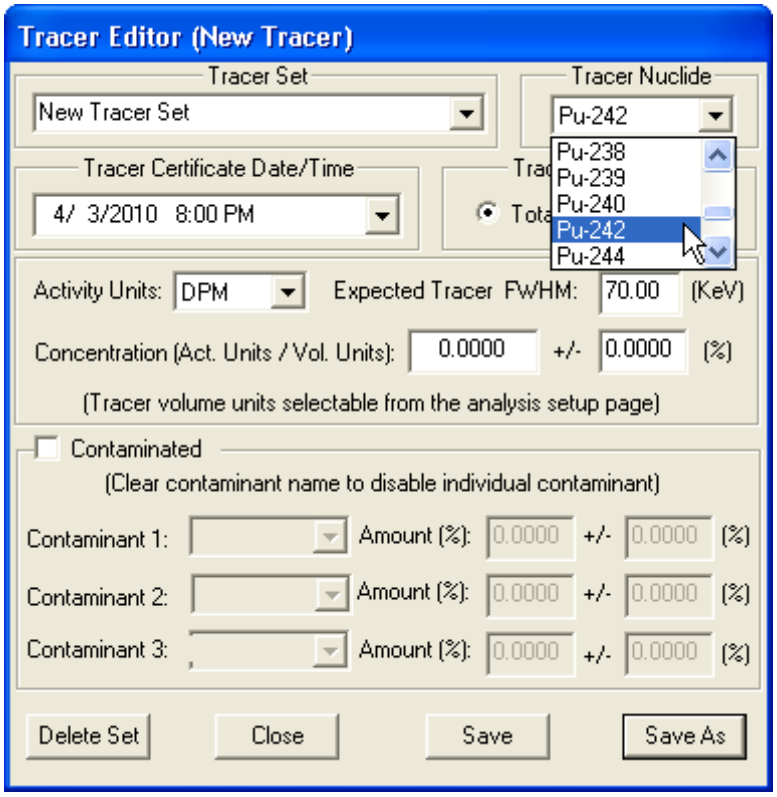


Fig. 118.

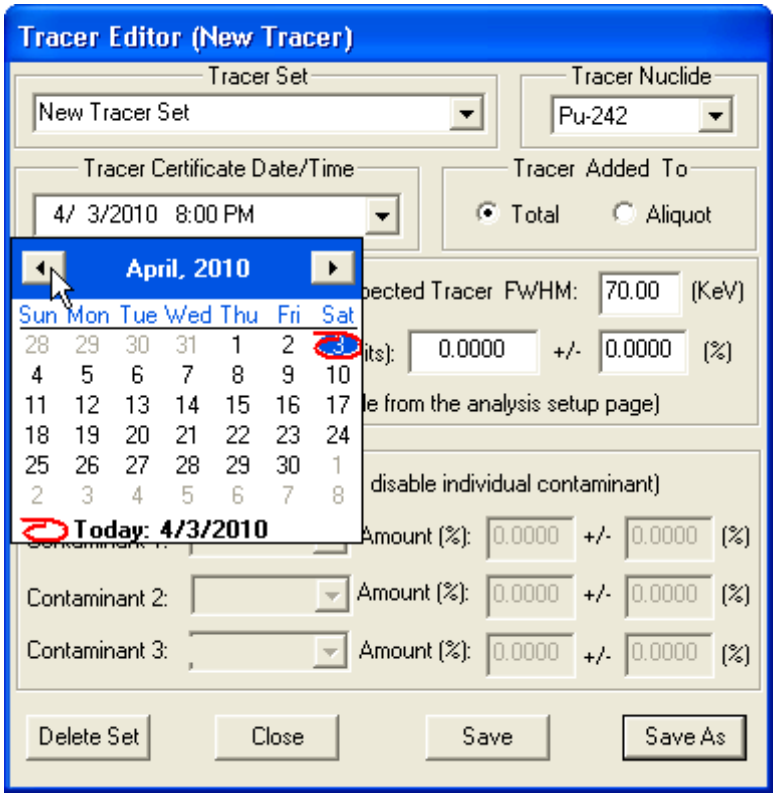


Fig. 119.

7. AlphaVision v5.6 enables you to correct for the presence of up to 3 alpha-emitting contaminants in the tracer solution. Our ^{242}Pu tracer is free of contaminants so we will leave this feature disabled for the tutorial; see **Tracer Editor** in the HTML Help Manual for a complete discussion.

8. The new Tracer Set is complete except for a name. Click on **Save As** and assign a unique **New Name** — *ABC Pu242* in this example — to the new record (Fig. 120).

9. To exit the dialog and return to the main AlphaVision screen, click on **Close**.

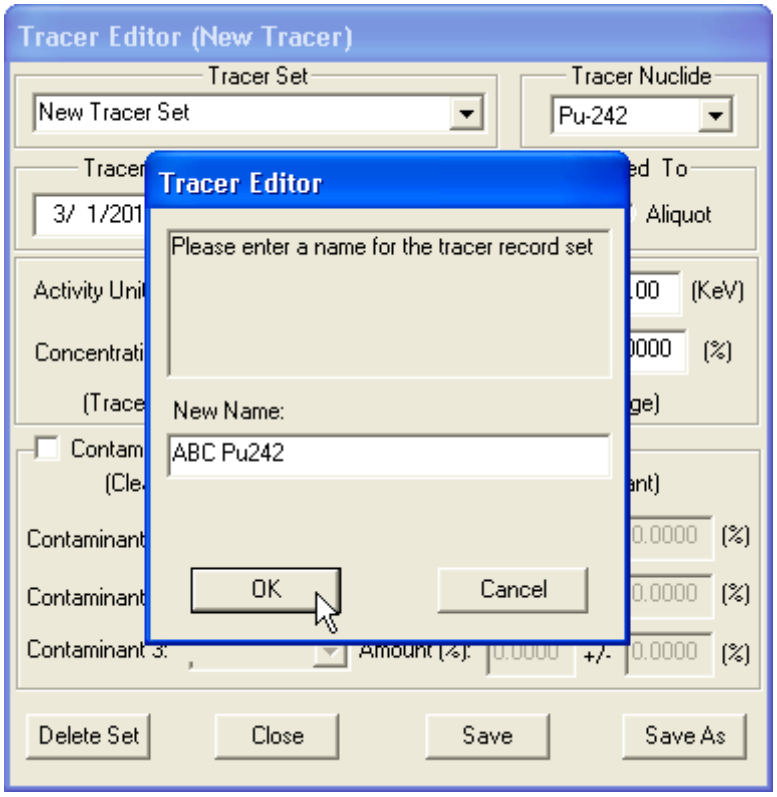


Fig. 120.

This Tracer Set record is now available for sample analysis.

5.1.4.4. Creating Control Sample, Reagent Blank, and Chemical Recovery QA Types

There are three **QA Type**s in AlphaVision v5.6:

- The **Control Sample QA Type** is used to track the recovery of control standards for a specific project.

- The **Reagent Blank QA Type** is used to track the count rate of batch blanks for a specific project.

- The **Chemical Recovery QA Type** tracks the chemical recovery (or yield) of a tracer. It allows you to quickly discriminate between different sample types within a project, and between similar (but perhaps not quite identical) sample types for different projects.

All three QA Types are set up similarly. In the next part of this tutorial we'll cover the creation of the Control Sample QA Type in detail, then quickly describe setup for the Reagent Blank and Chemical Recovery types.

Before you can create a Control Sample QA Type, you must have previously set up the nuclide library that will be used for the analysis of this type of control sample — for this tutorial, use

ABC Pu Library. In addition, you must already have created the Control Solution record corresponding to this QA Type, in this case, *ABC Pu-239 Control*.

1. On the menu bar, click on **Edit/QA Types...**. The main QA Types dialog will open (Fig. 121).

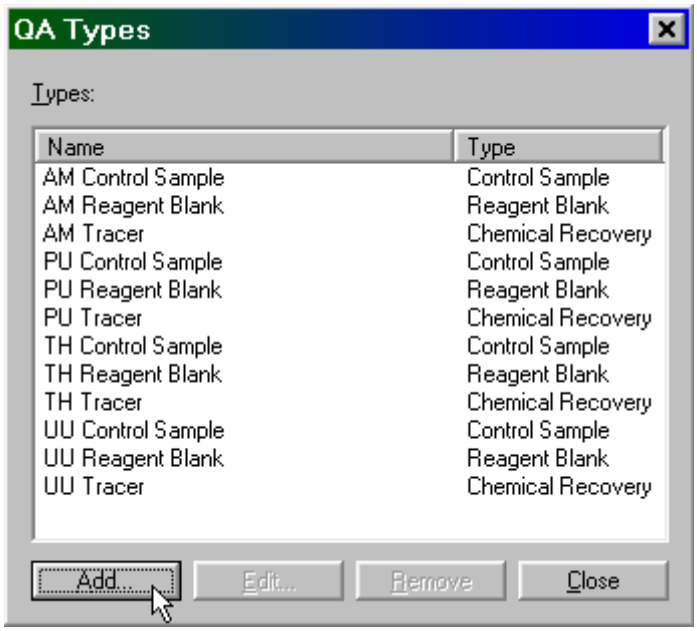


Fig. 121.

2. Click on **Add...** to open the QA Type dialog (Fig. 122).

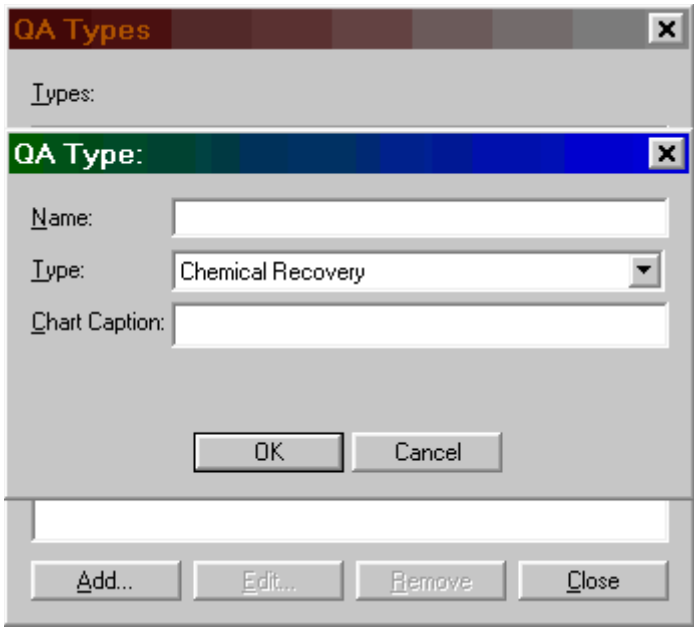


Fig. 122.

3. Click on **Type** and select the **Control Sample** QA Type from the droplist. An additional field, **Library**, will be added to the dialog.

4. Enter a useful **Name** for the new type.

5. Enter a **Chart Name** that describes the purpose of the chart — for this example, we are using *Pu-239 in Soils, Control, ABC contract #1234*.

6. Click on the browse (**...**) button and select the library we created earlier for this analysis, *ABC Pu Library* (Fig. 123).

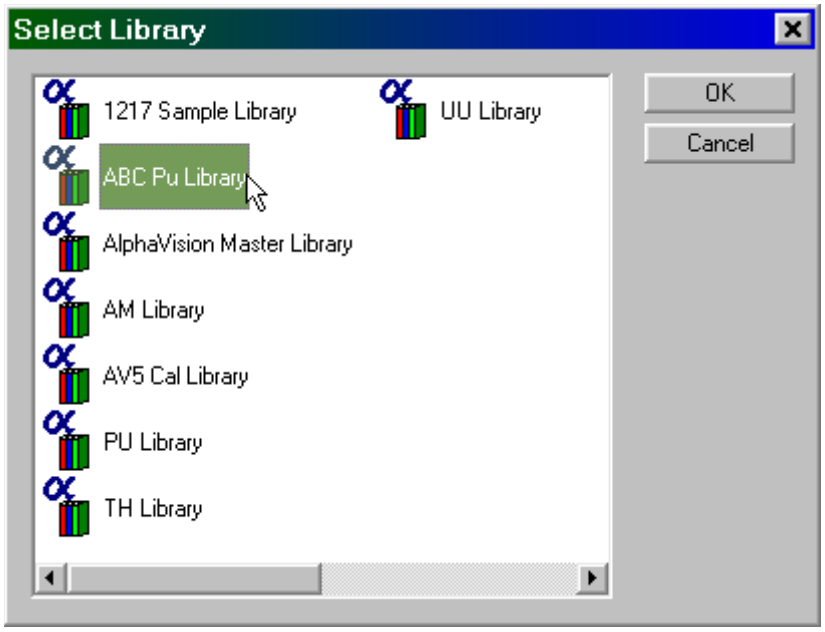


Fig. 123.

7. Click on **OK** to return to the main QA Types dialog (Fig. 124).

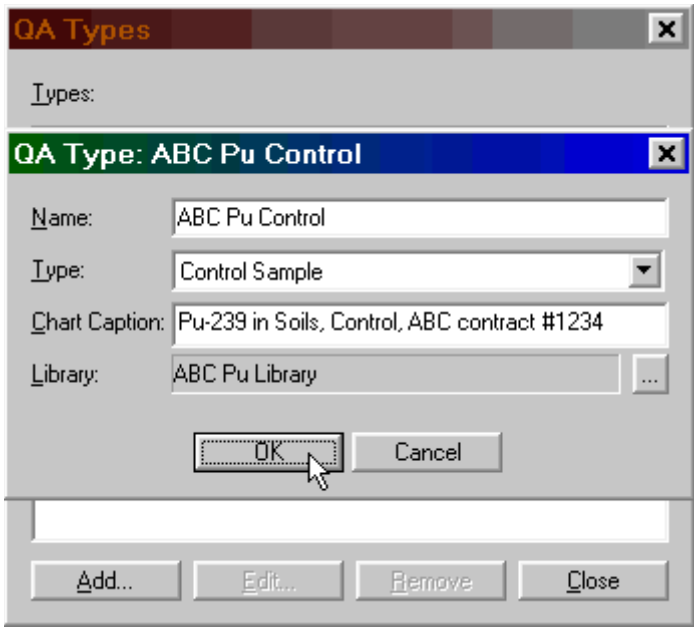


Fig. 124.

8. At this point you could click on **Close** and return to the main AlphaVision screen, but we still need to set up a Reagent Blank and a Chemical Recovery QA Type. Click on **Add** and select the **Reagent Blank QA Type** from the droplist. Next, enter *ABC Pu Blank* as the **Name**; and *Pu-239 in Soils, Blank, ABC contract #1234* as the **Chart Name** . Click on the browse (**...**) button and select the library we created earlier for this analysis, *ABC Pu Library*, then click on **OK** (Fig. 125).

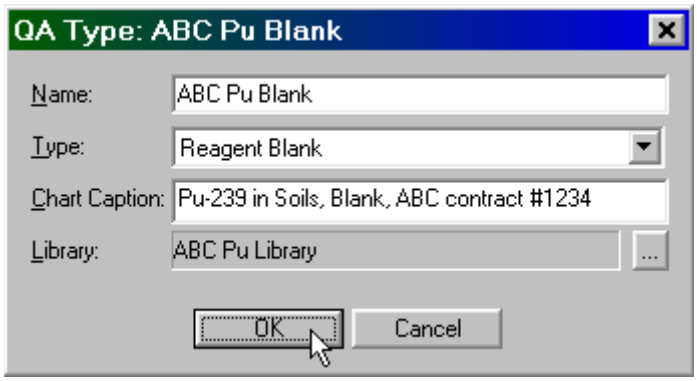


Fig. 125.

9. Click again on **Add** and select **Chemical Recovery QA** Type from the droplist. Assign *ABC Pu242 CR* as the **Name**; and *Pu-242 CR, ABC contract #1234* as the **Chart Name**; then click on **OK** (Fig. 126).

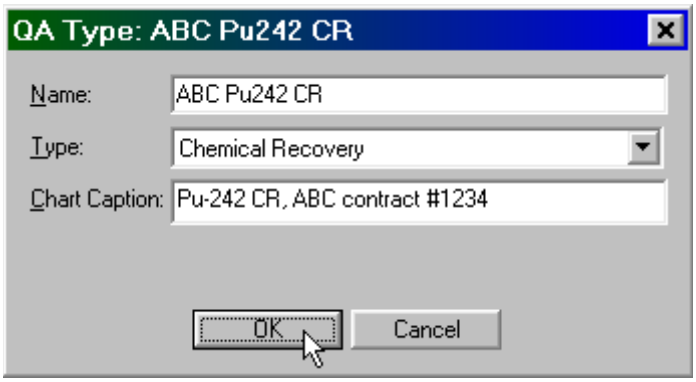


Fig. 126.

10. Click on **Close** to return to the main AlphaVision screen.

5.1.4.5. Creating an ROI Set that Includes ^{239}Pu and ^{242}Pu Peaks

The last step before creating batches is to create an ROI Set that contains a peak for ^{239}Pu and ^{242}Pu. This ROI Set will then be used during the batching tutorial to identify the peak positions for these isotopes. In this example, we are using an ROI Set, *ABC Pu ROI*, that contains ^{238}Pu, ^{239}Pu, and ^{242}Pu, and repeating the procedure we used on page 85 to create our calibration ROI Set (Fig. 127).

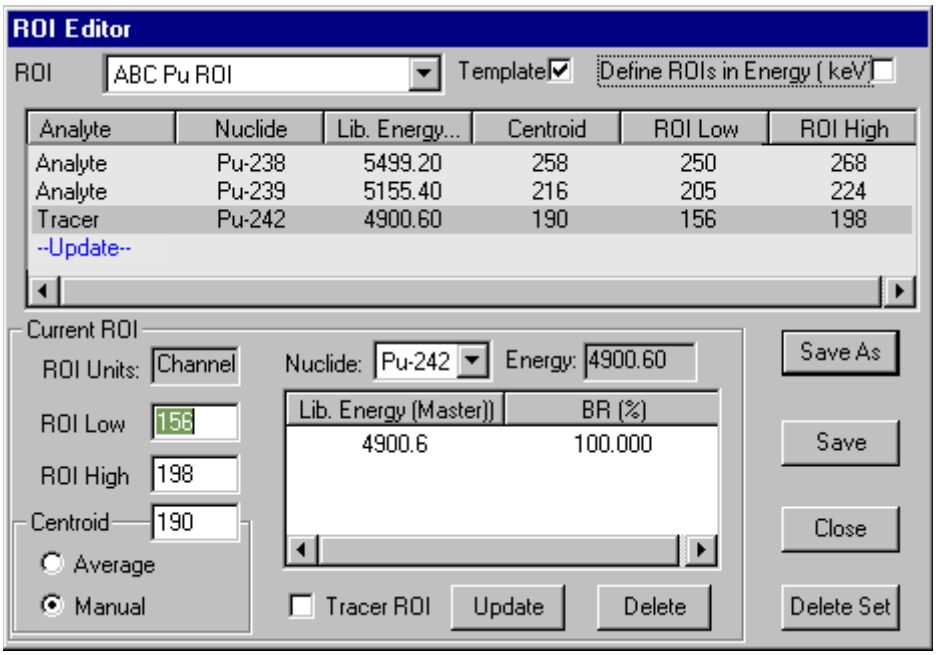


Fig. 127.

You are now ready to create batches, start counting samples, and track QA parameters.

5.1.5. Step 4 — Creating and Running Batches

5.1.5.1. Setting Up the Batch Explorer Tree Before a New Project

The Batch Explorer Panel is an intuitive, visual representation of your batch and sample data and its "location" in the AlphaVision v5.6 database. Batches are organized hierarchically in levels and sublevels that you define. Therefore, before we start batching we need to set up the Batch Explorer Tree (the left-hand column of the Batch Explorer Panel) to reflect the nature of the project.

1. On the Outlook Toolbar, click on the **Batch** icon.

2. In the left-hand column of the Batch Explorer Panel, locate the part of the default tree labeled Batches. Right-click on this branch and choose **Insert Branch...** from the right-mouse-button menu (Fig. 128). Headings with plus (+) boxes beside them contain subordinate entries. As you click on a plus box, its subordinate "branches" expand one level and the plus sign changes to a minus sign (−). Click on the minus box to collapse the branch.

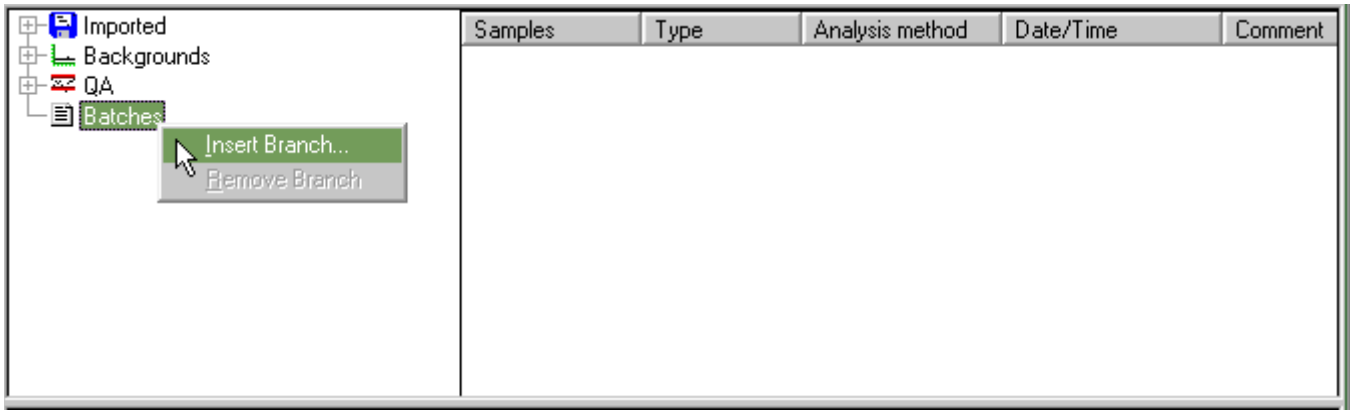


Fig. 128.

3. Enter *ABC Soils 2001* in the Insert Branch dialog (Fig. 129) and click on **OK** to return to the main screen (Fig. 130). A branch can be removed (right-click and select **Remove Branch...**) until you have assigned a batch to it.

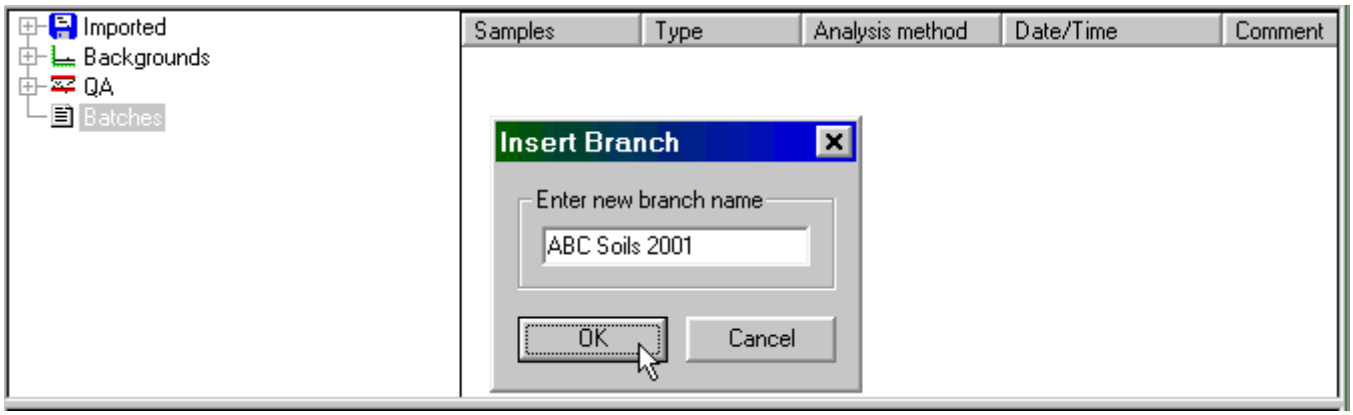


Fig. 129.

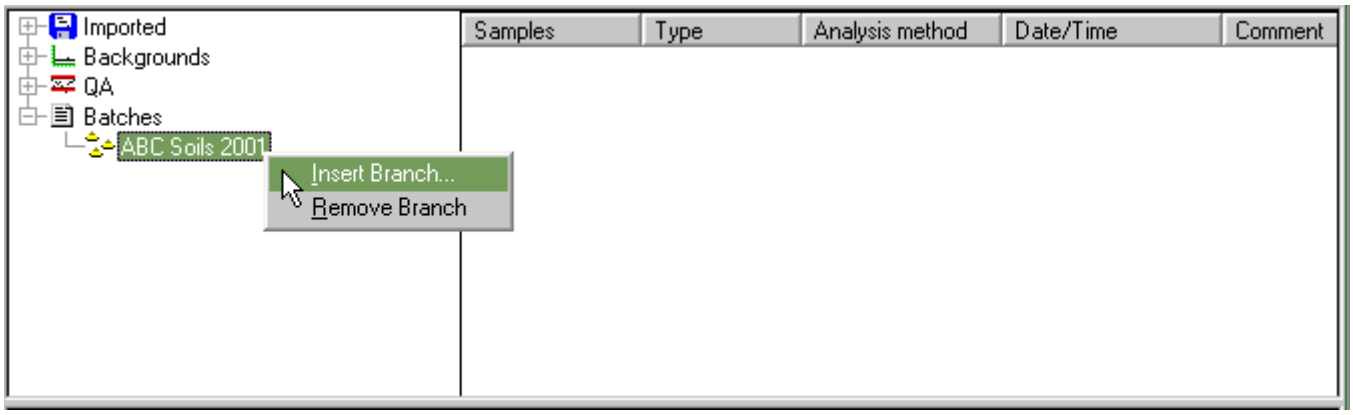


Fig. 130.

4. To further refine the Batch Explorer Tree for this project, right-click the newly created *ABC Soils 2001* branch and select **Insert Branch...** again. Enter *Pu Analyses* in the Insert Branch dialog and click on **OK** (Fig. 131).

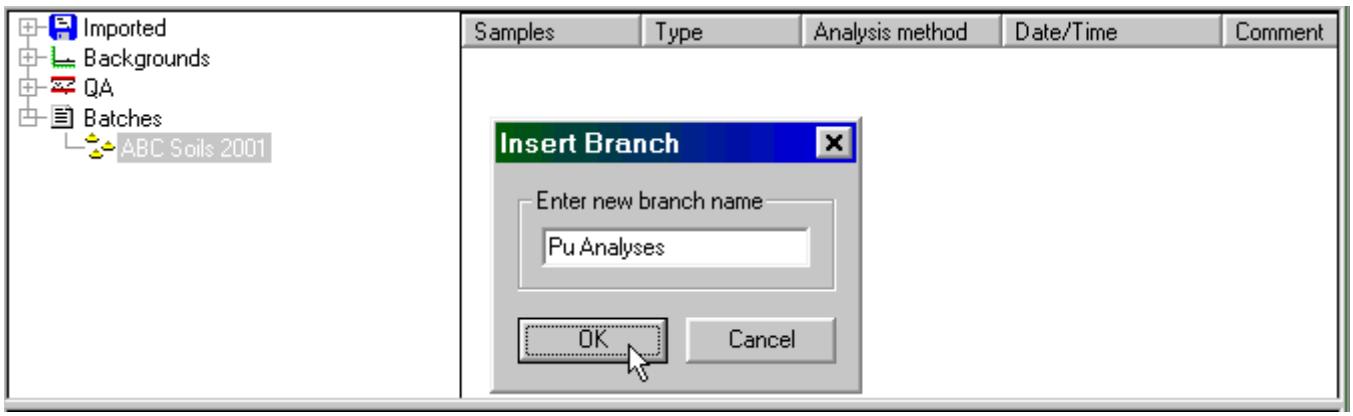


Fig. 131.

5. Since the example project is expected to last for 5 months, we'll insert five sub-branches — *June*, *July*, *August*, *September*, and *October* — under the *Pu Analyses* sub-branch. To do this, right-click on *Pu Analyses* and select **Insert Branch...**. Enter *June* in the Insert Branch dialog and click on **OK**. Repeat for the remaining months (Fig. 132).

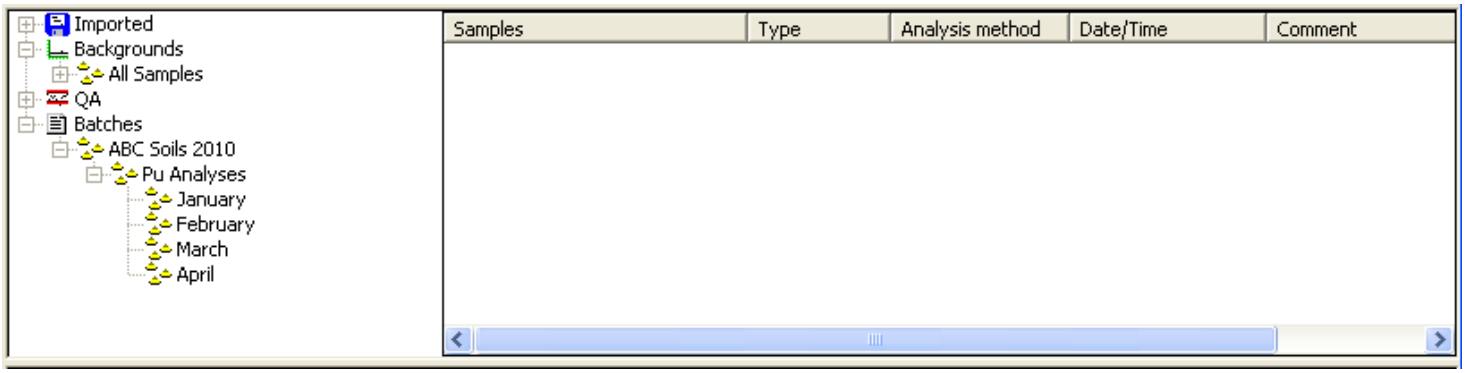


Fig. 132.

5.1.5.2. Batching Samples with the Batch Wizard

1. On the menu bar, click on **Process/Batch...**. This will open the first Batch Wizard page, General (Fig. 133). This page enables you to **Name** the batch; decide whether to base it on an existing **Template** of acquisition, analysis, and reporting parameters; and decide whether to save this setup as a new template. Notice the default naming scheme in the format *yyyy.mm.dd 001* (002, 003, etc.). You can either use this default name or enter any combination of alphanumeric characters. In this example we'll name our group of 5 samples *ABC Batch 1*, and will not be using or creating a template. You may also want to enter a **Description** of the batch. This will be stored in the database for use in the Analysis Report. Click on **Next** to go to the Batch Properties page.

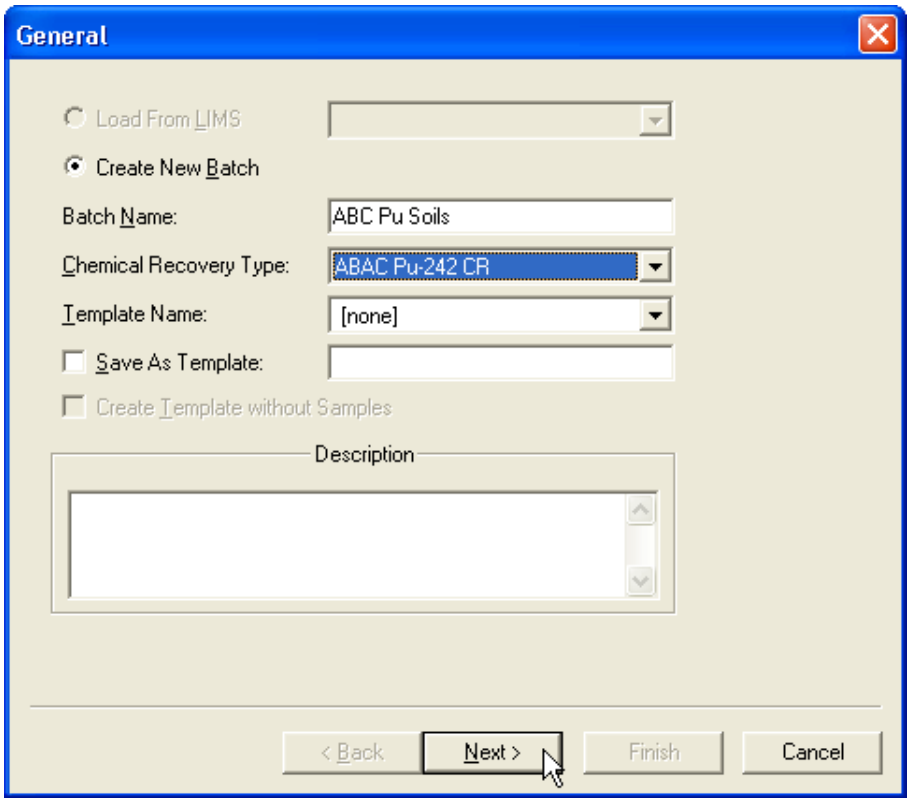


Fig. 133.

2. The Batch Properties page allows you to assign this batch to the proper "location" within the AlphaVision v5.6 database so you can easily find the results in the future. You must choose a destination branch before you can move to the next page of the wizard. The Batch Properties screen displays the Batch Explorer Tree, including the *ABC Soils 2001* project, and its sub-level *Pu Analyses* with 5 subordinate levels, *June* through *October*. Click on the plus (+) boxes to expand the tree to display all levels for *ABC Soils 2001* and *Pu Analyses*, then click on *June*. The spectra, analyses, and reports for this batch will now be viewable from this location in the Batch Explorer (Fig. 134).

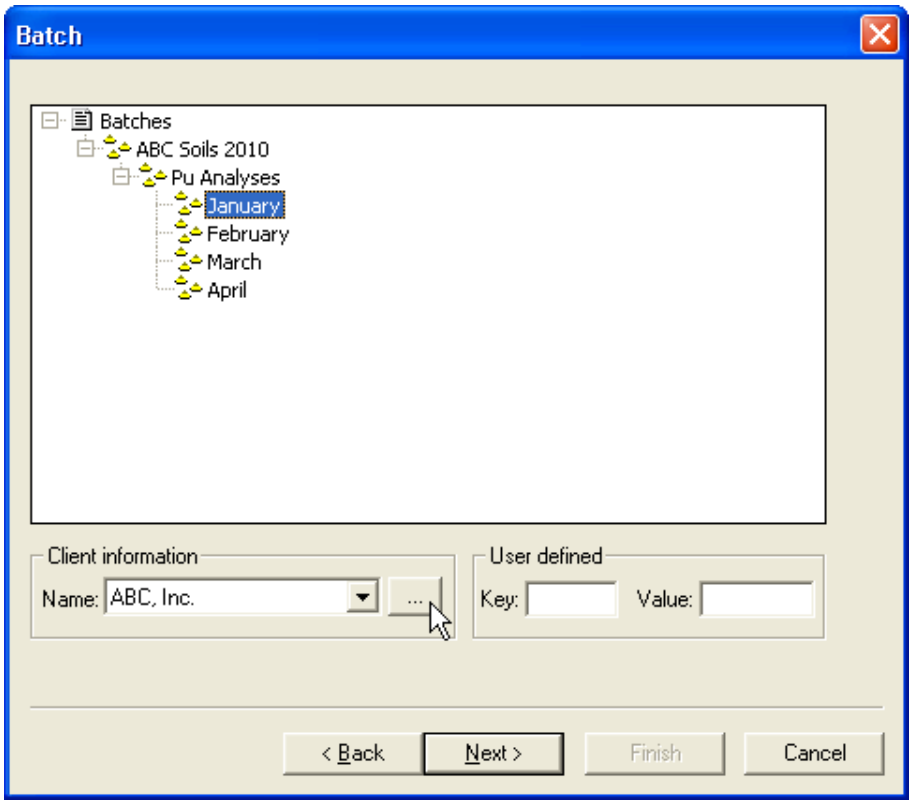


Fig. 134.

3. Next we'll input **Client information**. This is your "onboard" client information directory. The contents are stored in the database, and **Company Name** and **Contact Name** are printed on the Analysis Reports. Click on the browse (**...**) button to open the Client Information dialog (Fig. 135). For the purposes of this tutorial, we will only enter the **Company Name** and **Contact Name**. Click on **OK** to return to Batch Properties (Fig. 136), then click on **Next** to go to the Sample Properties page.

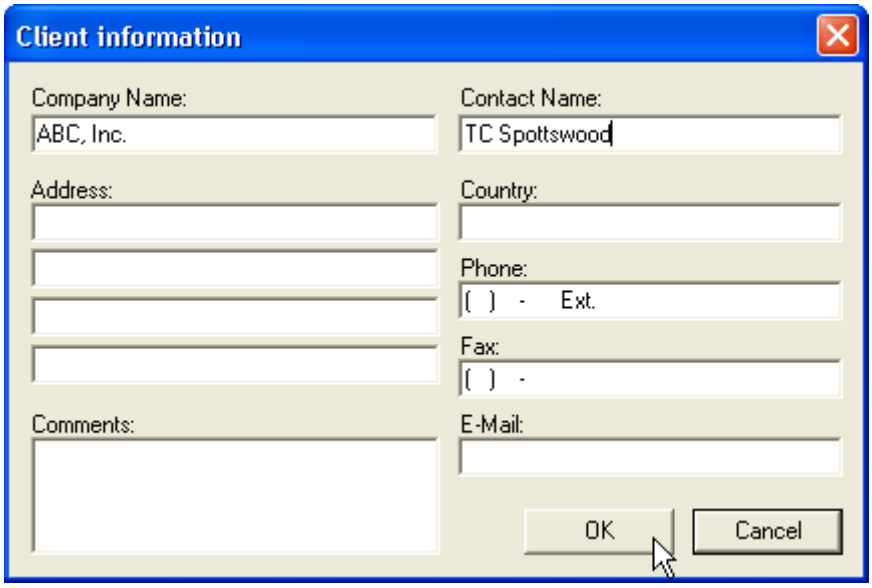


Fig. 135.

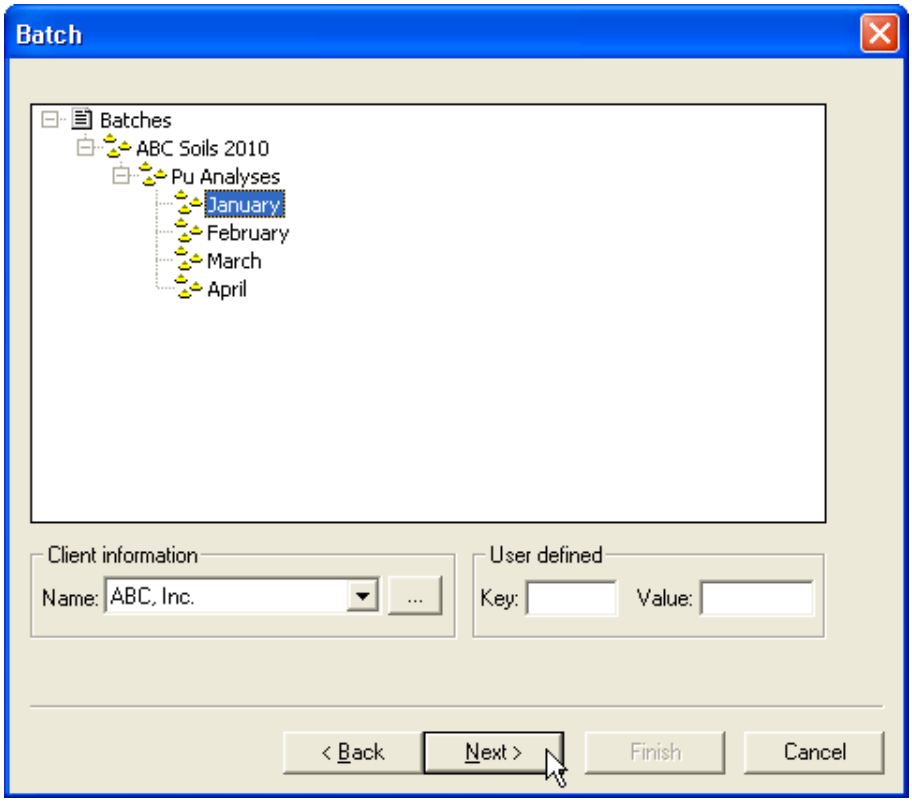


Fig. 136.

4. The Sample Properties screen allows you to document each sample in the batch in detail and specify its treatment, including sample name, QA Type, volume and other physical characteristics, a descriptive comment, and the date to which the sample should be decay corrected. Note that AlphaVision v5.6 also has an auto-sample-creation feature (Section 1.4.4.1), however, we will not use it in this tutorial.

   The contract requirements for the ABC Project call for a blank and a control for each batch. Click on **Add** to create the first entry, which will be the control. Enter the name *ABC Pu Control* in the Sample dialog (Fig. 137) and click on **OK** to return to the Sample Properties dialog. Next, click on the sample **Type** droplist and select **Control** (Fig. 138). For a control sample, AlphaVision will add fields for **QA Type**, control solution record (**Cntrl Sol**), and the **Volume** of control solution used. Choose our already defined *ABC Pu Control* **QA Type**; use *ABC Pu-239 Control* as the **Cntrl Sol**; and enter a **Volume** of 0.5 mL. Next, select **Volume** as the **Sample Units** and use the default unit, mL. The lower right section of the dialog allows you to set up 1 or 2 dilutions. In this case, we will be using the entire sample volume of 1.0 mL, so keep the default **Total** selection and volume entry, with no uncertainty, as shown in Fig. 139. (The dilution feature is discussed in Section 1.5.3.)

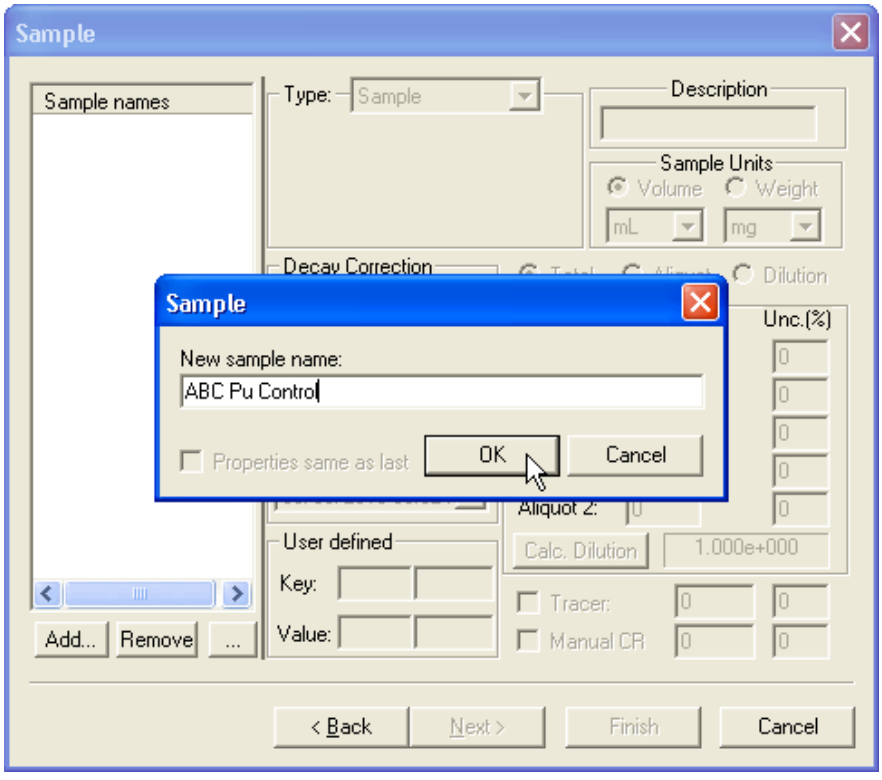


Fig. 137.

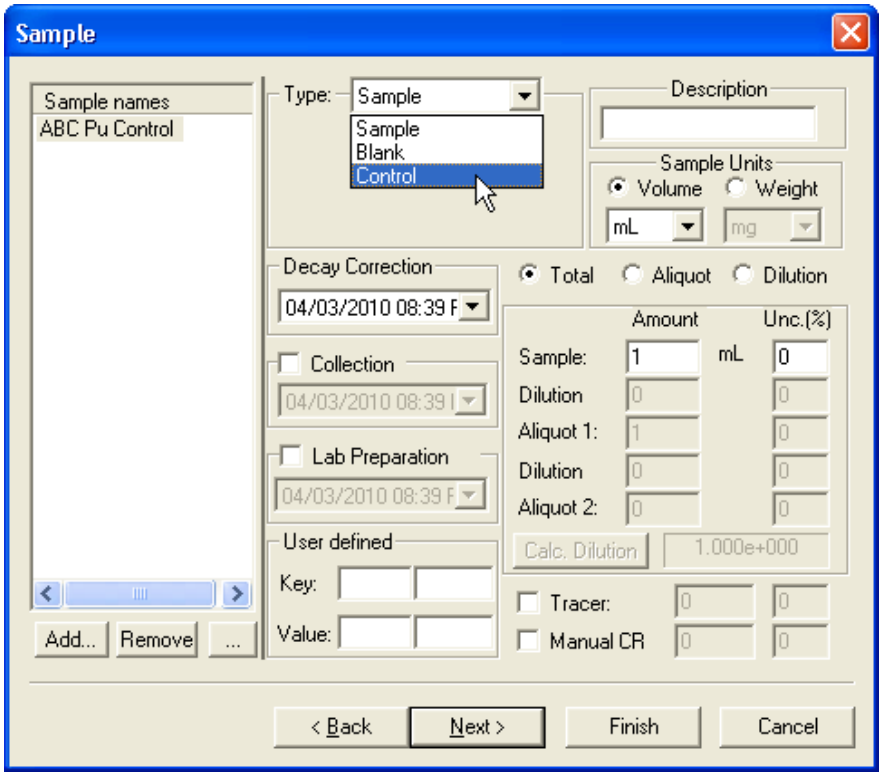


Fig. 138.

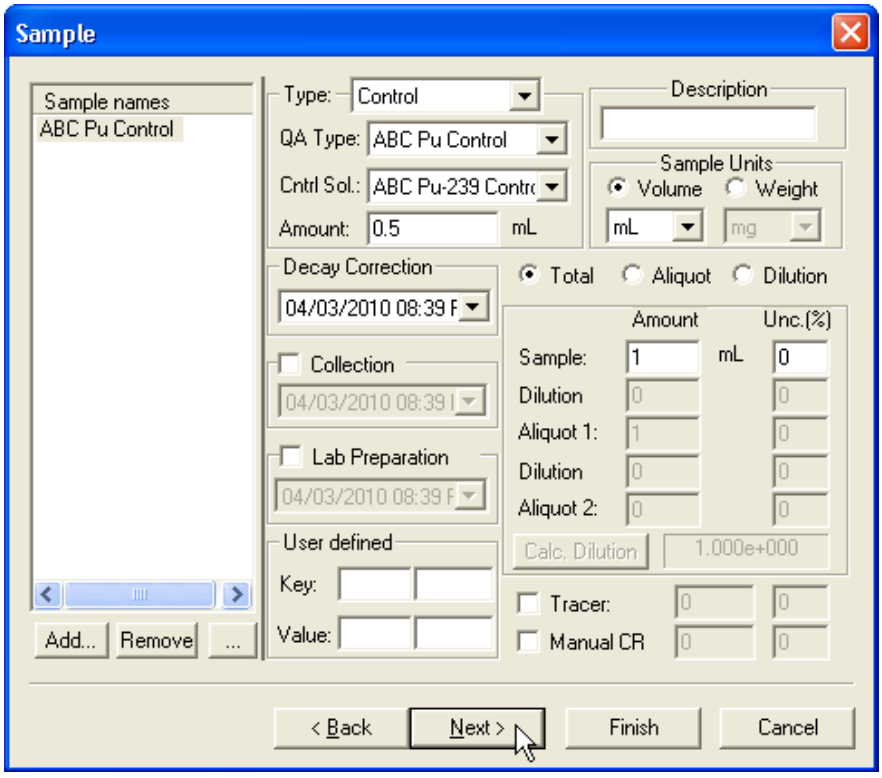


Fig. 139.

AlphaVision v5.6 gives you three ways to determine chemical recovery:

- By adding individually tailored quantities of tracer to one or more samples. To tailor the tracer quantities, mark the **Tracer** checkbox at the bottom right of the screen; then enter the tracer volume and, optionally, a percent uncertainty. (The tracer volume units are set on the template's Analysis Setup page.)

- By entering a percent chemical recovery, determined by an alternative method (e.g., a gamma counting technique). *This value is applied to all samples in the batch.* No tracer set is required. To use this method, mark the **Manual CR (%)** checkbox and enter the percent recovery and percent uncertainty.

- By adding a fixed quantity of a predefined tracer solution to each sample in the batch. To do this, use the **Tracer Amt** field on the Analysis Setup screen of the wizard. In this tutorial, we will use this method, as discussed on page 122.

NOTE For a detailed discussion on using the **Define Tracer Amount** feature for individual samples, see the AlphaVision HTML Help Manual; on the Index tab, enter *Tracer*.

You can also specify the **Decay Correction**, sample **Collection**, and **Lab Preparation** dates by marking the associated checkboxes and setting the date/time. To decay correct to other than the batch acquisition date/time, select another **Decay Correction** date with the date/time tool (presumably you will be setting all samples in the batch to a common decay correction date). In this exercise, we will not use these features.

5. Next, create the reagent blank record. Click on **Add**, enter *ABC Pu Blank* in the Sample dialog, and click on **OK** (Fig. 140). Select **Blank** from the **Type** list. In response, AlphaVision will add a **QA Type** field to the screen. Select our example *ABC Pu Blank* **QA Type**, then enter the sample **Weight** or **Volume**, uncertainty, and **Aliquot** size as needed (again, we are using the default values; see Fig. 141).

6. Finally, add *Sample 01*, *Sample 02*, and *Sample 03* to the list. Select **Sample** from the **Type** list and use the default weight/volume values (Fig. 142). Click on **Next** to advance to the Acquisition page.

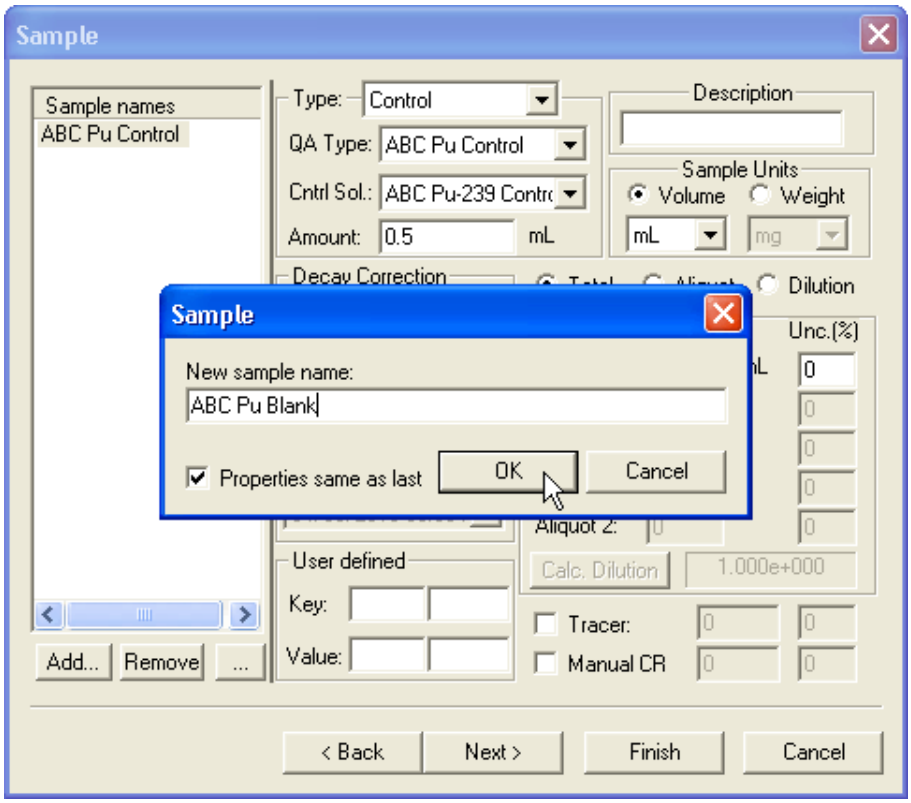


Fig. 140.

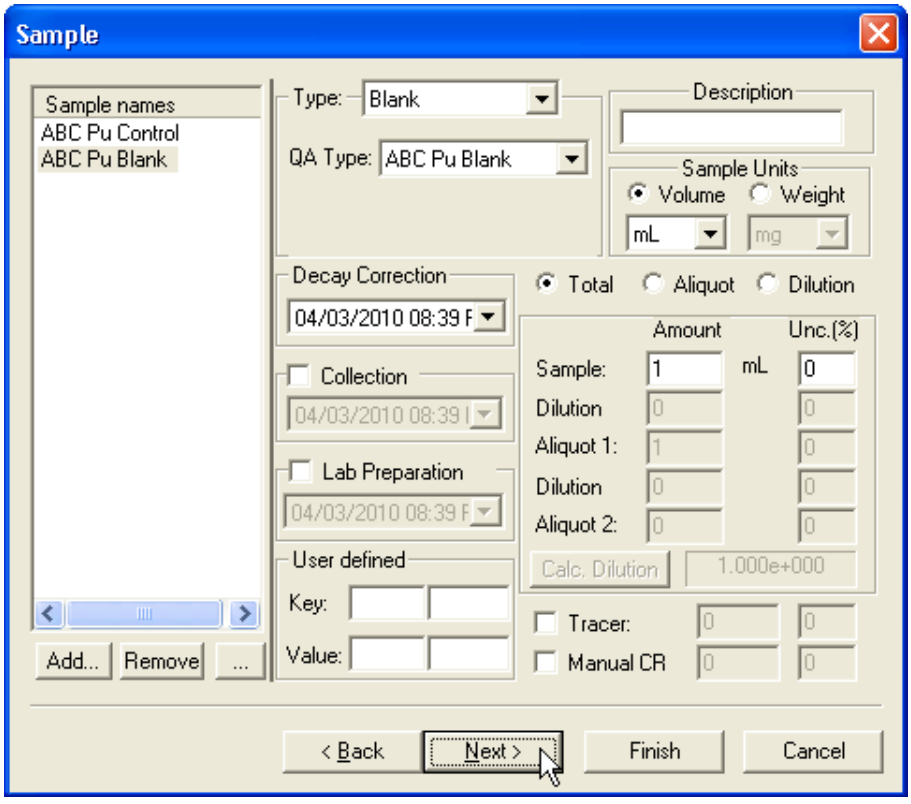


Fig. 141.

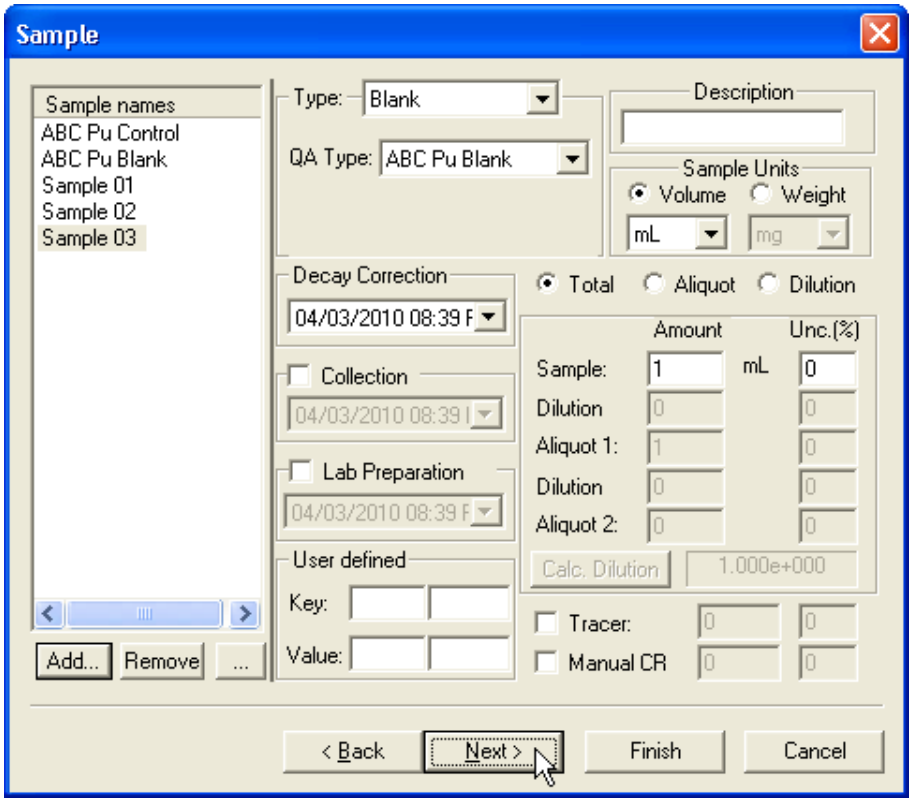


Fig. 142.

7. Figure 143 shows the Acquisition page. For the tutorial we will use the default **Live Time** preset, so leave the box checkmarked and enter a count time; our example is 5 hours. We will not be using an MDA preset so leave the **MDA** checkbox unmarked.

8. Note the **Thresholds** fields in the middle of the screen. These fields allow you to specify chamber pressure (**Max Vacuum**), bias (**Min Bias**), and detector leakage current (**Max Leakage I**) limits that control data acquisition. If one of these parameters exceeds the threshold you have specified, data acquisition is automatically suspended until the problem is corrected. As soon as the pressure or leakage current drop below the limits, acquisition restarts automatically. In this exercise we are using a **Max Vacuum** of 30 Torr, a **Min Bias** of 45 V, and a **Max Leakage I** of 1000 nA. Click on **Next** to go to the Analysis Setup page.

9. On the Analysis Setup page (Fig. 144) you'll set up the analysis method for your batch. First, you must select a **Nuclide Library**. Click on **Select...** to open the Nuclide Library dialog, and choose our library, *ABC Pu Library*, from the list of **Available Libraries** (Fig. 145). Enter the maximum allowable peak shift (**Max. Peak Mismatch**) and click on **OK**. This value is a threshold that tells AlphaVision the maximum allowable difference between the expected tracer peak energy and the observed peak energy for a given count. Define this value according to your operating procedures. For this example, we will use the default value of 100 keV. Click on **OK** to return to the Analysis Setup page.

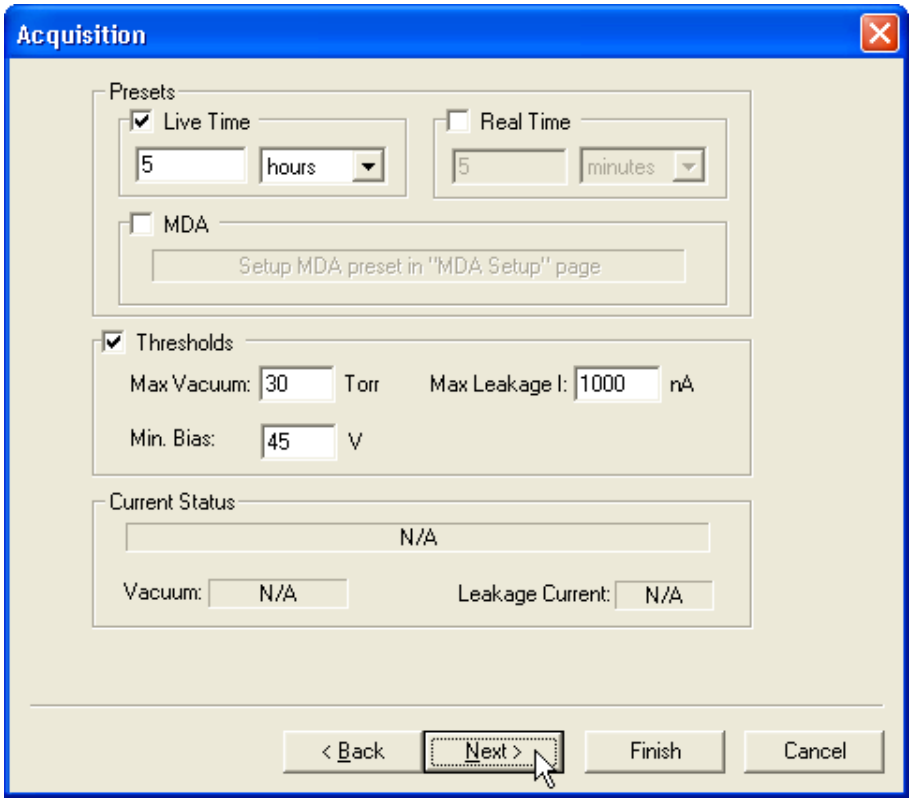


Fig. 143.

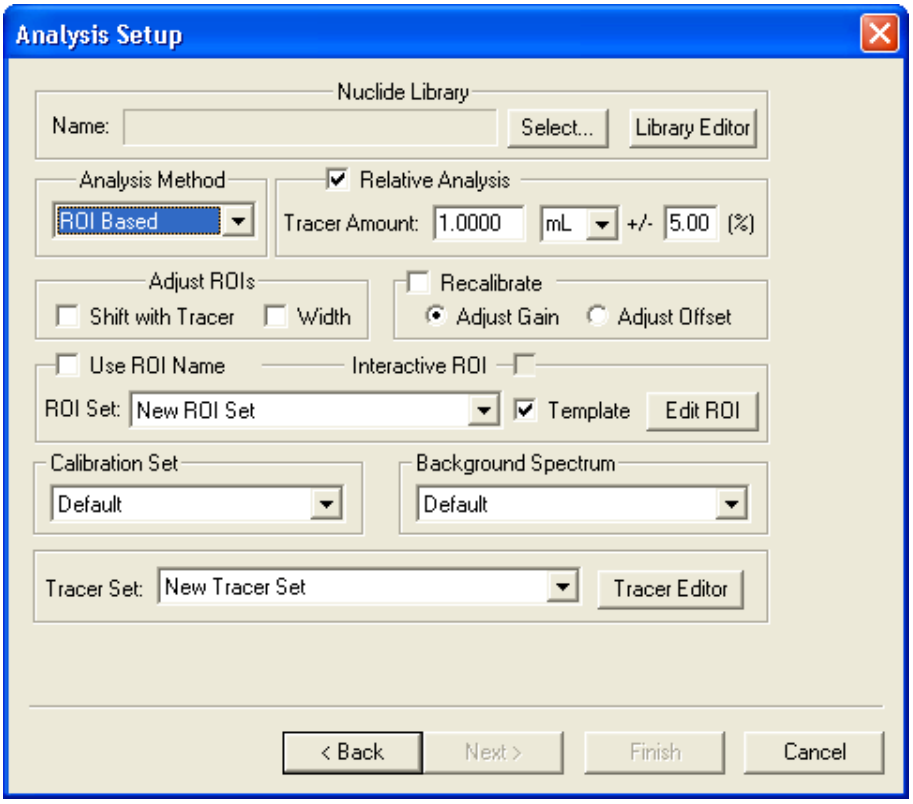


Fig. 144.

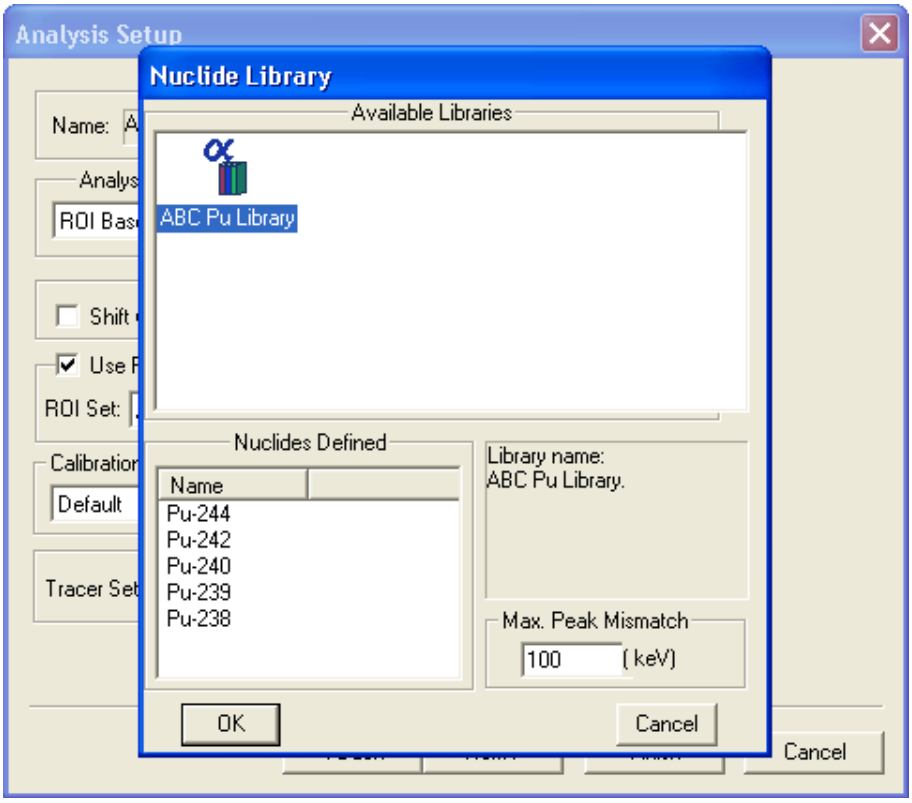


Fig. 145.

10. Next, choose the Analysis Method. AlphaVision v5.6 can perform **No Analysis**, an **ROI Based** analysis, or more sophisticated **Peak** or **Library Search/Fit** techniques. In this example, we will choose **ROI Based** analysis. To complete an ROI analysis, you must specify a set of spectrum regions in the form of an ROI Set. In this tutorial, we will select *ABC Pu ROI* from the **ROI Set** droplist. (Alternatively, you can do this after data acquisition by completing the remainder of the wizard, counting the samples, then returning later and completing the analysis.)

11. Because we are using an alpha-emitting tracer in this batch (^{242}Pu), we are performing a **Relative Analysis**, so leave this checkbox marked and enter the **Tracer Amt.** that was added to all of the samples (Fig. 146). You may also wish to enter the uncertainty (+/-) associated with the tracer amount. Next, choose our example **Tracer Set**, *ABC Pu242*, from the droplist. Instead of using a predefined **Tracer Set,** you can create a new one (or modify an existing one) with the Tracer Editor. Click on **Next** to go to the Analysis Misc. page.

12. On the Analysis Misc. page (Fig. 147) you will specify how AlphaVision calculates and reports the analysis results. In this example, ABC, Inc., has required that we report the results in DPM/mL. To do so, choose **DPM** from the **Activity Units** droplist (we have already specified the volume as **mL** on the Sample Properties page). Click on **Activity Concentration** to report in specific activity units.

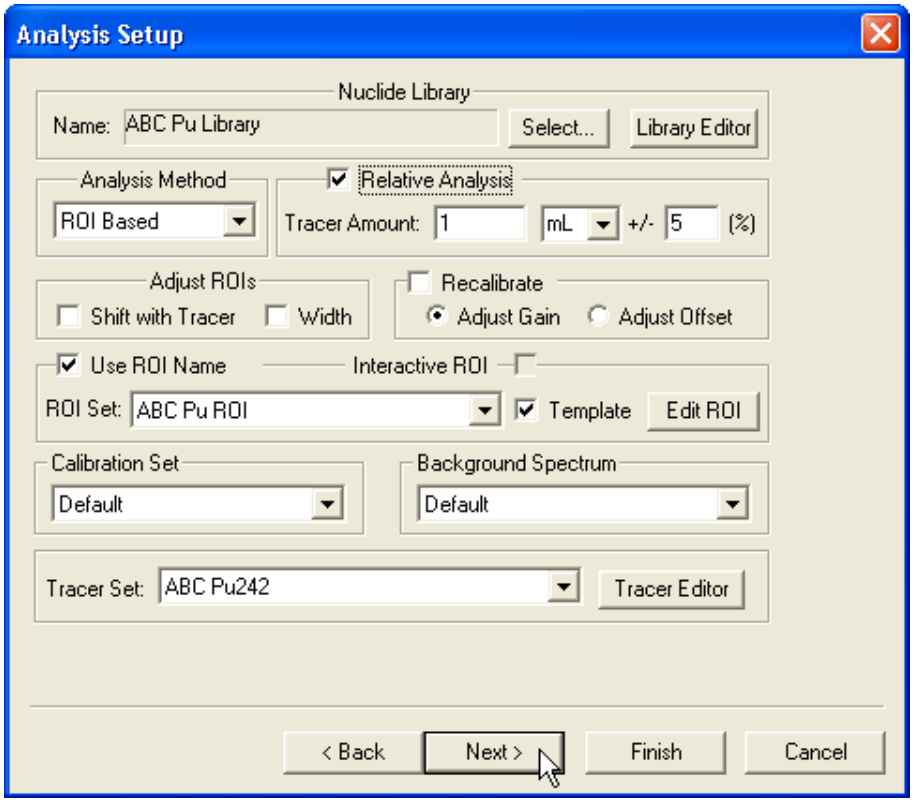


Fig. 146.

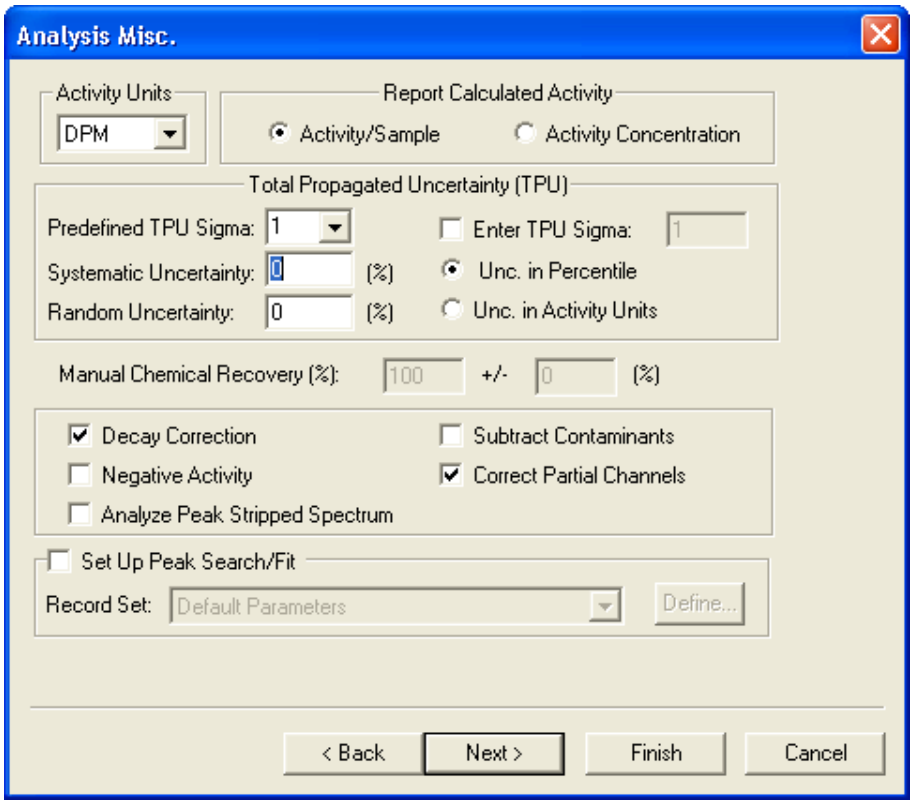


Fig. 147.

13. ABC further requires that we report uncertainities at the 95% confidence level using a sigma multiplier of 1.96. AlphaVision defaults to a **Predefined TPU Sigma** of 1 (you can also choose 2 or 3 from this droplist). To enter a non-integer value, click on the **Enter TPU Sigma** checkbox, then enter the corresponding value. We will use a sigma multiplier of 1.96, as shown in Fig. 148. You can also add **Systematic** and **Random** uncertainties that are not included in mass and volumetric uncertainties input when creating tracers, entering sample properties, etc. These uncertainties can be input as **Unc. in Percentile** or **Unc. in Activity Units**; activity units are restricted to the units chosen for reports. If you choose **Unc. in Activity Units**, percent uncertainties are converted to the appropriate units for reports.

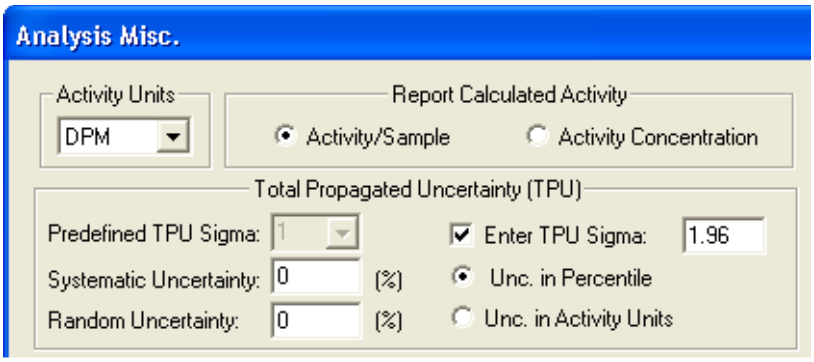


Fig. 148.

14. The **Manual Chemical Recovery** option is disabled in this example because we opted to perform a **Relative Analysis** on the Analysis Setup page. **Manual Chemical Recovery** refers to methods, other than using an alpha-emitting nuclide, of estimating the chemical recovery of analytes. Examples of this approach are the use of ^{234}Th (a beta emitter) for chemical recovery determination of thorium analyses and ^{239}Np (also a beta emitter) for chemical recovery for neptunium analyses. In these cases, the user typically opts for a **No Analysis**, then returns later and analyzes each sample — using the laboratory-determined chemical recovery — at the completion of alpha counting.

15. Leave the **Decay Correction** checkbox marked (the default setting). This is the "master control switch" for decay correction. Here is how it works: By default, AlphaVision decay-corrects to the data acquisition date/time. However, you can instead specify a different decay-correction date/time, *for each sample in a batch*, on the Sample Properties page. If you then change your mind about using the alternative decay-correction date, you can turn it off (i.e., return to using the default decay-correction time) by unmarking the **Decay Correction** box here on the Analysis Misc. page. This saves the time involved in returning to the Sample Properties page and turning off the correction for each sample.

16. Because we have selected an **ROI Analysis** on the Analysis Setup page, the **Set Up Peak Search/Fit** section of the screen is inactive. Click on **Next** to move to the MDA Setup page.

17. Screen 7 of the Batch Wizard is the MDA/Blank setup (Fig. 149). The elements of configuring an appropriate MDA calculation are beyond the scope of this tutorial and are discussed in the Analysis Methods. Subtracting net blank activity is discussed in Sections 1.5.8 and 7.7.12.2. In this example, we are using the default settings to determine the MDA for each sample: a paired-background solution (the ANSI N13.30 equation [**ANSI Standard**]), **Background Spectrum** as the **MDA Source Type**, and the default **Confidence Levels** of 1.645 (95%, one-sided confidence interval). Click on **Next** to go to the Report Options page.

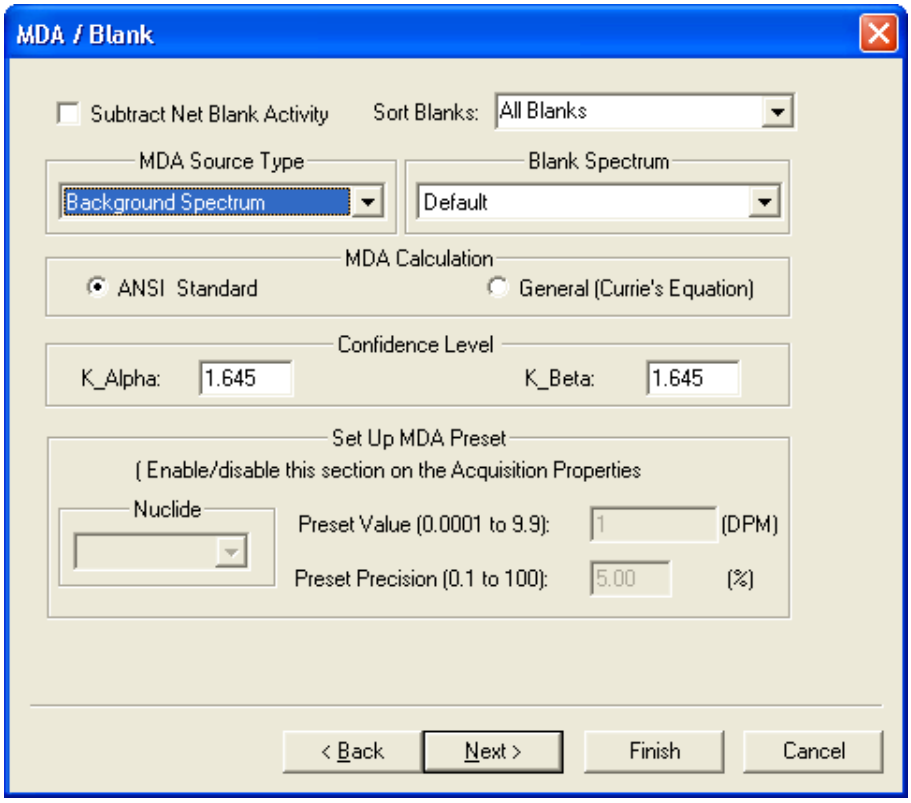


Fig. 149.

18. Report Options (Fig. 150) is the final screen in the Batch Wizard. This screen allows you to print out the analysis report to the default printer. In addition, you can export the results to Microsoft Excel 8.0, HTML 4.0, rich text format (**.RTF**), ASCII text, Microsoft Word **.DOC**, portable document format (**.PDF**), tabbed text, or **.XML** file. You can also export to a user-defined Crystal Reports template of your choice.[3] In this example, click on **Print on completion** to print a single copy of the results for each analysis.

[3]Note that the Report Window also allows you to print the report and export to a wider choice of formats.

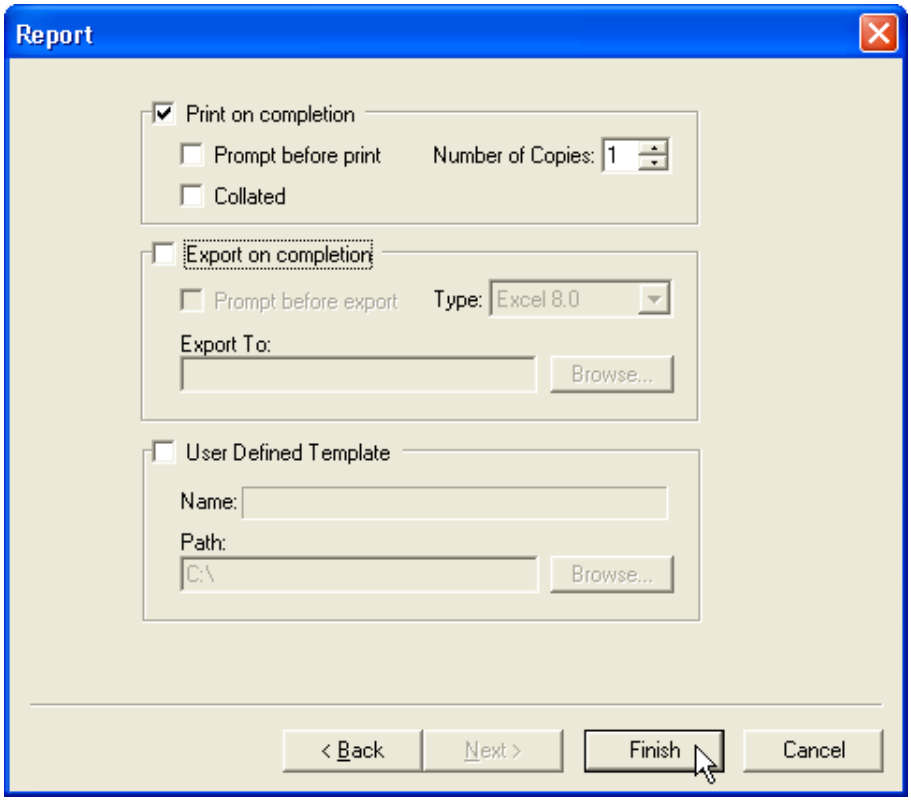


Fig. 150.

19. You have now completed the Batch Wizard setup. The next step is to click on **Finish**, after which you will assign the detectors that will acquire the data for this batch.

20. When the wizard closes, the Detector Assignment Worksheet will open (Fig. 151). This is your tool for assigning a detector to each sample in the batch and starting data acquisition.

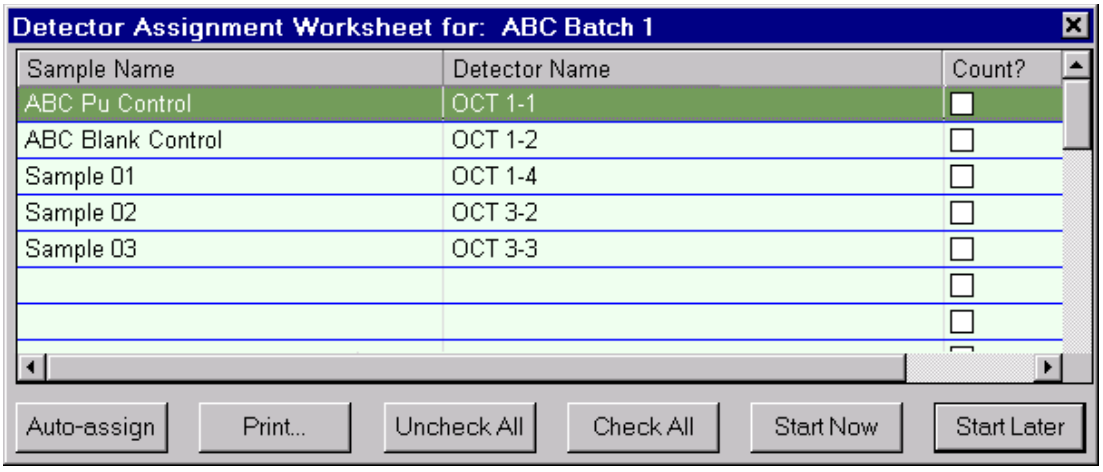


Fig. 151.

To assign a detector to a sample, go to the Detector Grid, locate an available detector, and drag and drop it on one of the samples on the worksheet. Repeat this for the remaining samples on the worksheet. You can instead assign detectors automatically by clicking on the **Auto-assign** button.

21. To start data acquisition, click on **Start Now**. The worksheet will close, acquisition will start, and the sample entries you've just made in the wizard will be displayed up in the Batch Explorer Tree under *Batches/ABC Soils 2001/Pu Analyses/June/ABC Batch 1*. In the right-hand column (the Sample Analysis Explorer) as soon as data acquisition begins on a sample, a spectrum record will be created for it. When analysis is complete, an analysis record Σ will be displayed beneath each spectrum analyzed. You can then click on the spectrum record to display the spectrum in the Spectrum Window, and click on the analysis record to see the analysis ROIs and peak identifications superimposed on the spectrum. At any time during acquisition, you can analyze samples by right-clicking on the spectrum record icon and selecting **Analyze** from the right-mouse-button menu.

When acquisition and analysis are done, the Batch Explorer Panel will look like Fig. 152.

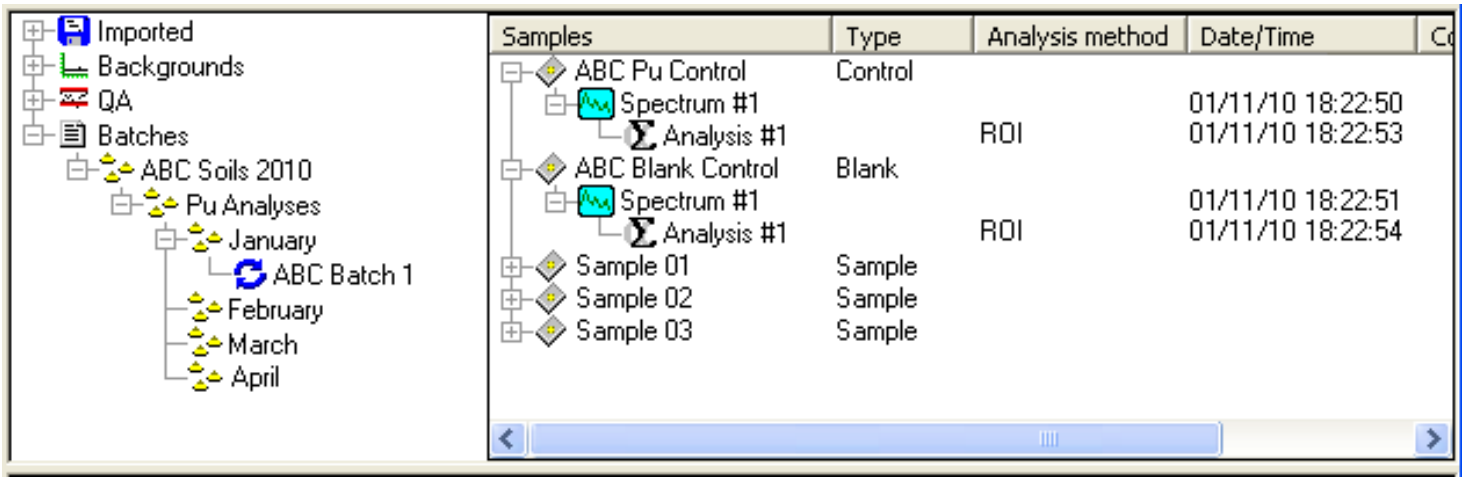


Fig. 152.

Congratulations — you're collecting sample data in AlphaVision v5.6! Next comes measuring detector backgrounds for QA/QC.

5.1.6. Step 5 — Measuring Isotope-Specific Detector Background

The fifth step in satisfying your contractual agreement with ABC, Inc., is to measure the ^{239}Pu background for each of the detectors you used to collect batch data above. The Batch Explorer Tree already has a predefined **Backgrounds** section (Fig. 153) so you're ready to use the Background Wizard, which is an abbreviated version of the Batch Wizard. You can now add levels and sublevels to the Backgrounds section, but in this tutorial we will not do so.

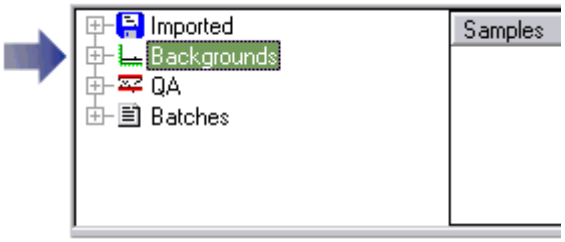


Fig. 153.

1. On the menu bar, click on **Process/Background...**. This will open the first Background Wizard page, General. It is essentially identical to General page of the Batch Wizard (see the discussion for Fig. 133, page 113).

   In this example we'll name our group of background measurements *ABC Bkg 1*, and will not be using or creating a template. You might also want to enter a **Description** of the background batch. This will be stored in the data-base for use in the Background Analysis Report (Fig. 154, 155). Click on **Next** to go to the Batch page.

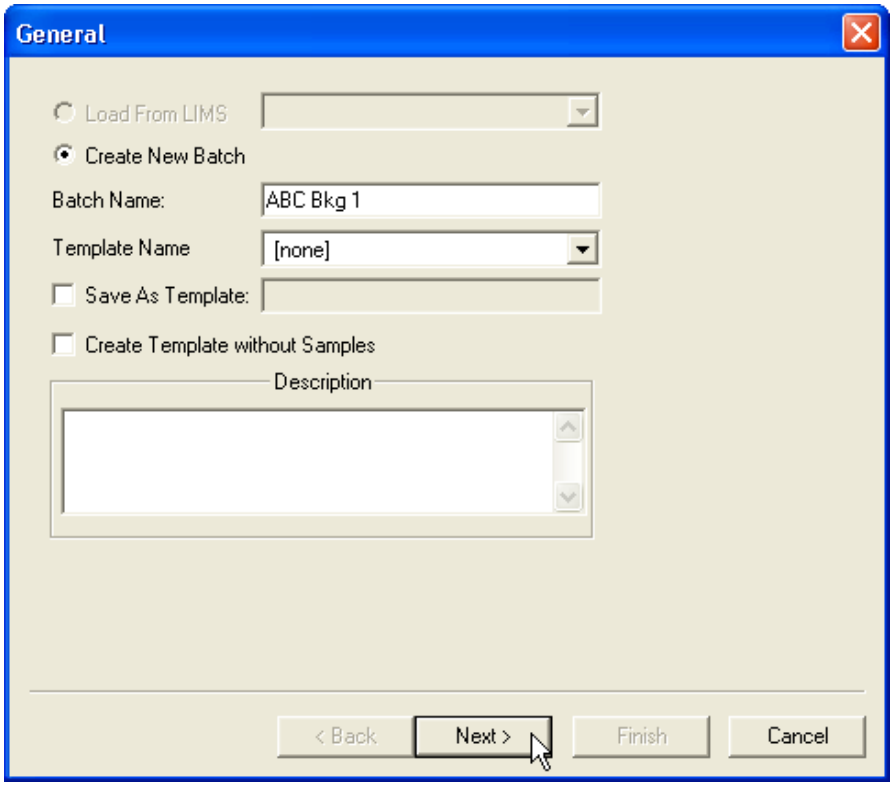


Fig. 154.

2. The Batch page requires you to assign this batch to the proper "location" within the database. It is identical to the Batch page in Batch Wizard (see the discussion for Fig. 134, page 114). You must choose a destination branch before you can move to the next page.

   For this tutorial, we will simply click on the **All Samples** branch in the Sample Explorer tree, as shown in Fig. 155. Click on **Next** to go to the Sample Properties page.

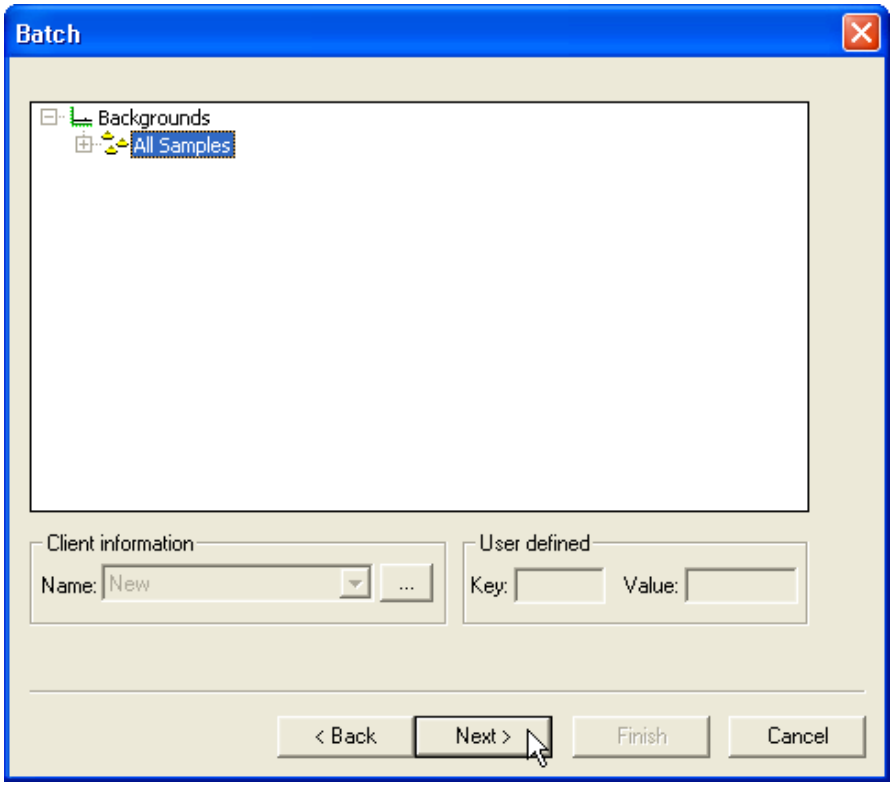


Fig. 155.

3. The Sample properties screen allows you to enter a **Name** and **Comment** for each background spectrum (the remaining fields are inactive). In this example, we'll name the backgrounds based on the names of the 5 detectors used for batching. Click on **Add** to create the first entry, enter the name *Bkg 1-1*, and click on **OK** to return to the Sample Properties dialog. Repeat this for the other 4 background entries, *Bkg 1-2*, *Bkg 1-4*, *Bkg 3-2*, and *Bkg 3-3* (Fig. 156). Click on **Next** to advance to the Acquisition page.

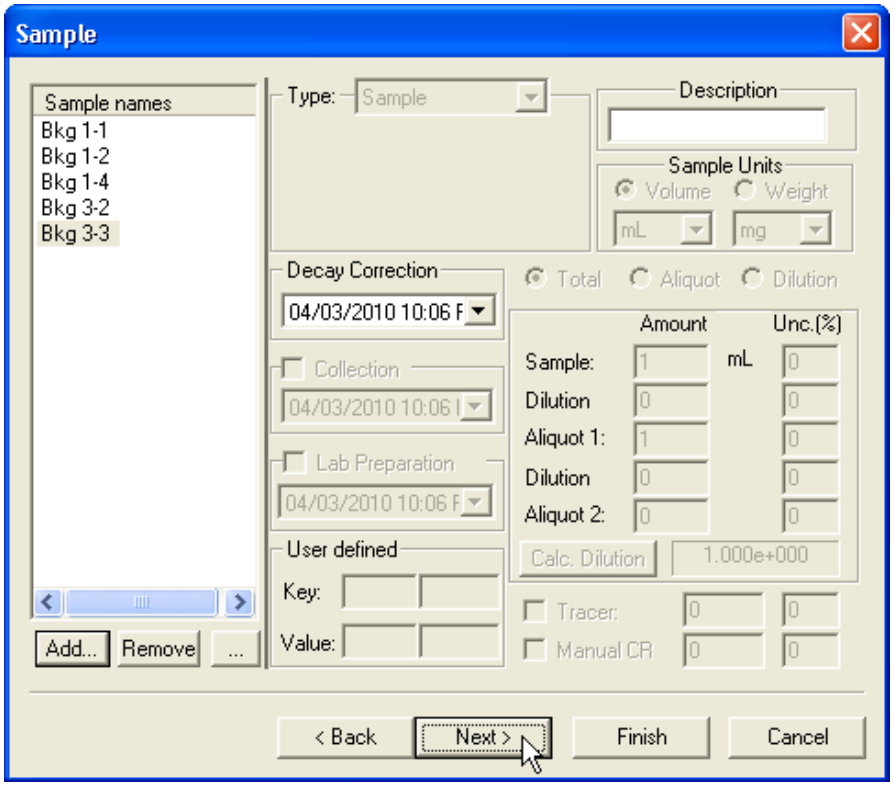


Fig. 156.

4. On the Acquisition Properties page, we will use the default **Live Time** preset, so leave the box checkmarked and enter a count time; our example is 5 hours (Fig. 157).

5. The **Thresholds** fields in the middle of the screen are identical to those for the Batch Wizard. See the discussion of these fields on page 120. In this exercise we are using a **Max Vacuum** of 30 Torr, a **Min Bias** of 45 V, and a **Max Leakage I** of 1000 nA. Click on **Next** to go to the Analysis Setup page.

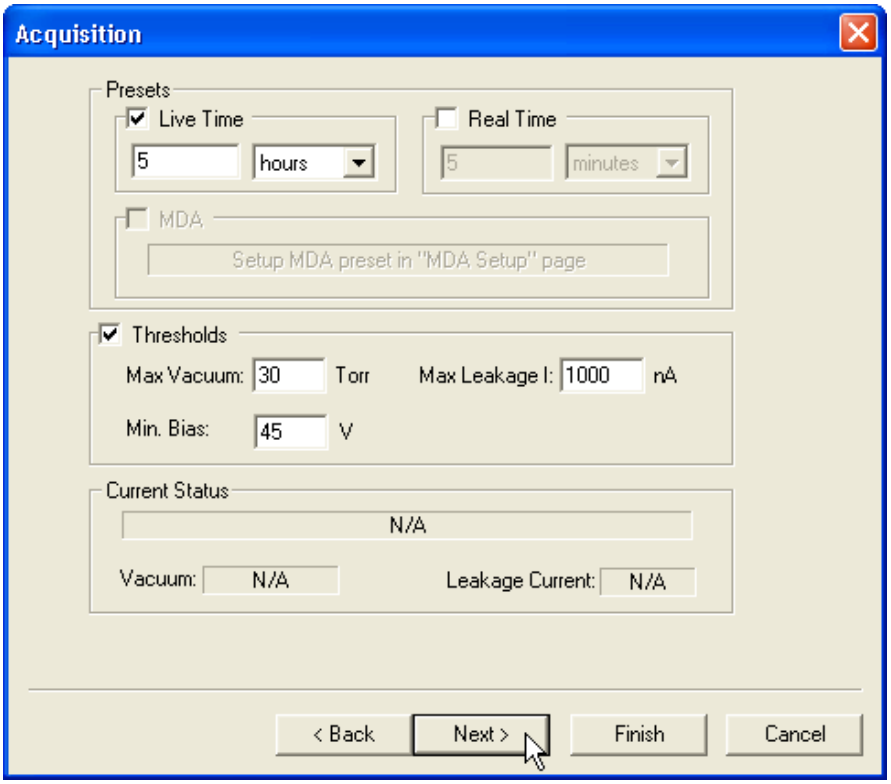


Fig. 157.

6. On the Analysis Setup page you'll set up the analysis method for your batch. First, you must select a **Nuclide Library**. Click on **Select...** to open the Nuclide Library dialog, and choose our library, ABC Pu Library, from the list of **Available Libraries** (Fig. 158). Enter the maximum allowable peak shift (**Max. Peak Mismatch**). Define this value according to your operating procedures. For this example, we will use the default value of 100 keV. Click on **OK** to return to the Analysis Setup page.

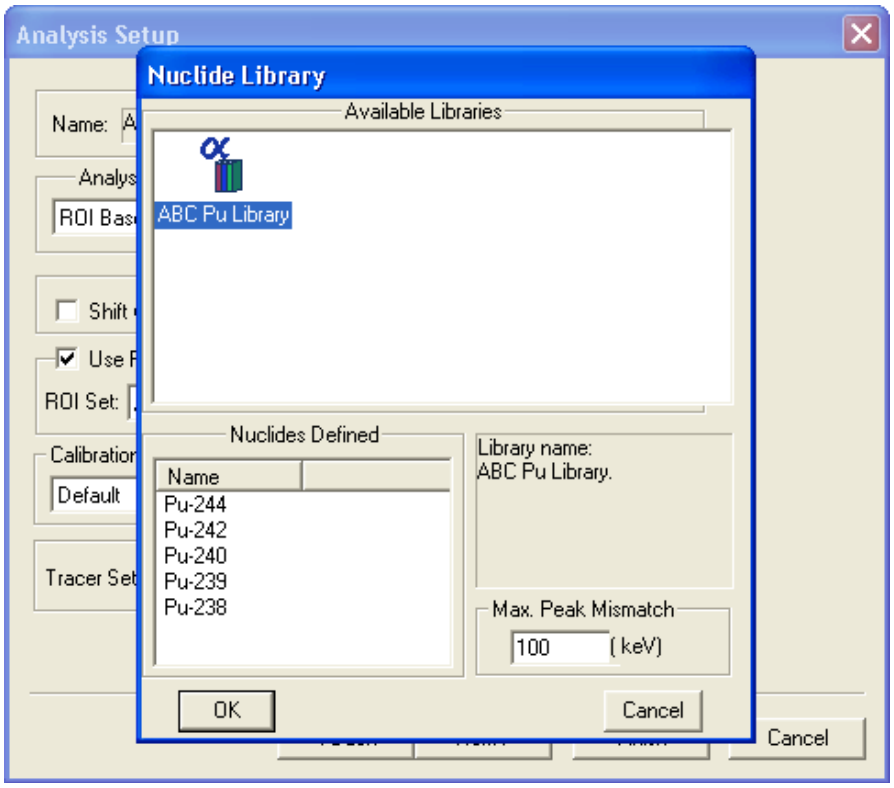


Fig. 158.

7. The Background Wizard uses the **ROI Based** analysis. To complete the ROI analysis, you must specify an **ROI Set**, a set of spectrum regions that correspond to the nuclide(s) you are monitoring in the background spectrum. In this tutorial, we will select our *ABC Pu ROI* set from the **ROI Set** droplist (Fig. 159). Click on **Next** to go to the Report Options page.

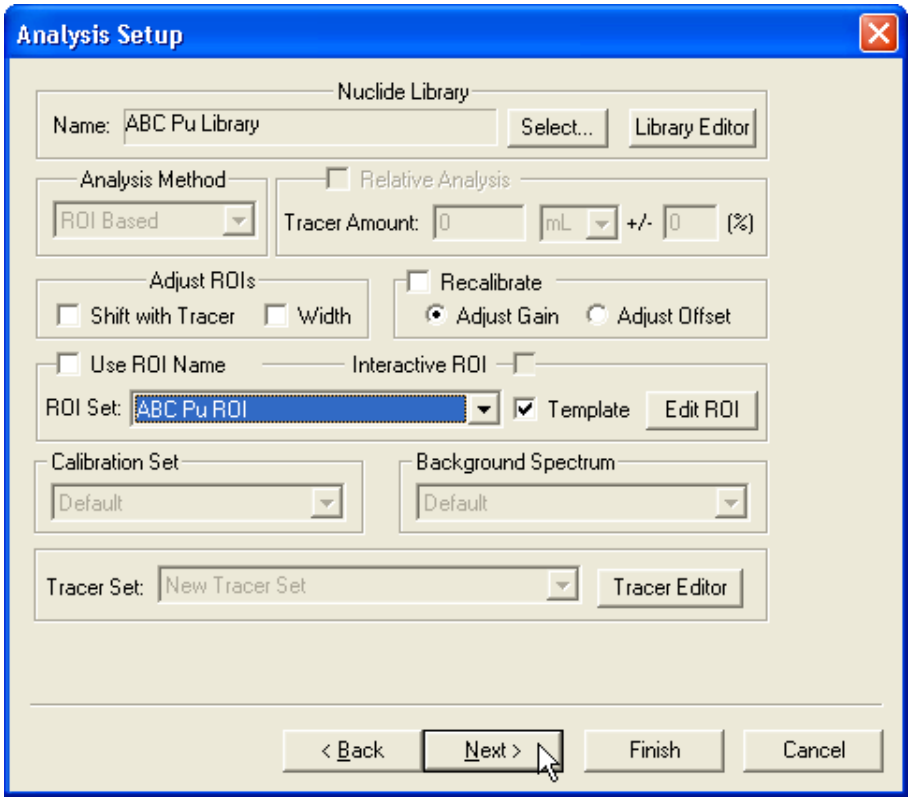


Fig. 159.

8. Report Options is the final wizard screen (Fig. 160). This screen allows you to export the results to Microsoft Excel 8.0, HTML 4.0, rich text format (**.RTF**), ASCII text, Microsoft Word **.DOC**, portable document format (**.PDF**), tabbed text, or **.XML** file. You can also export to a user-defined Crystal Reports template of your choice. You can also print the report and export to a wider choice of formats from the Report Window. In this example, click on **Print on completion** to print a single copy of the results for each background analysis.

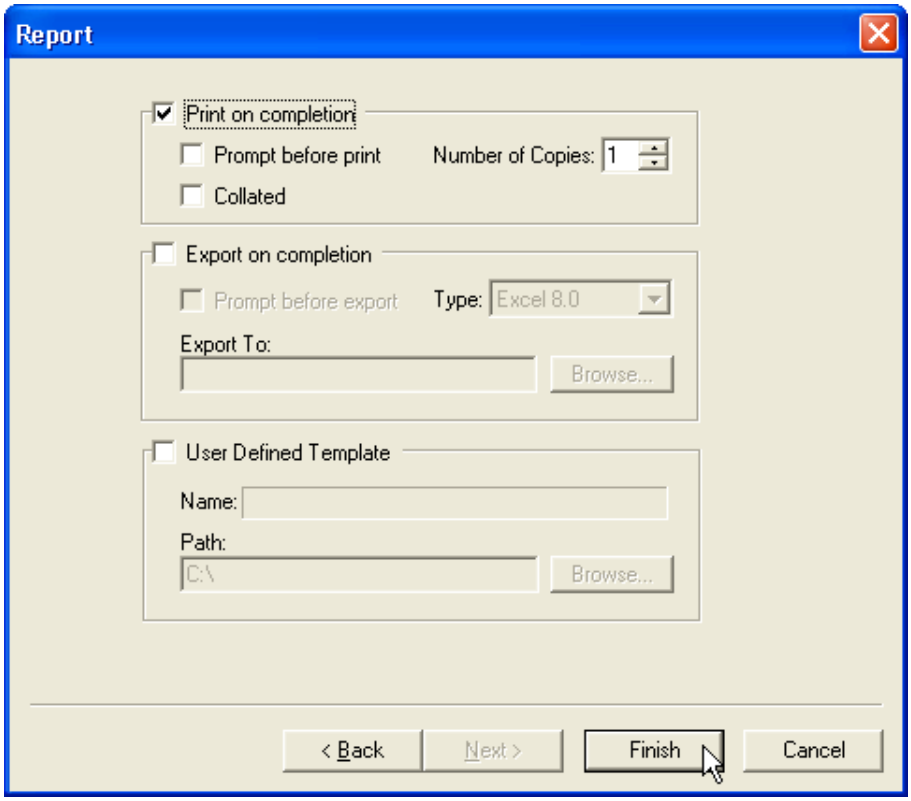


Fig. 160.

9. You have now completed the Background Wizard setup. The next step is to click on **Finish**, after which you will assign the detectors that will acquire the data for this set of backgrounds.

10. When the wizard closes, the Detector Assignment Worksheet will open (Fig. 161). This is your tool for assigning a detector to each background and starting data acquisition. To assign a detector to a sample, go to the Detector Grid, locate an available detector, and drag and drop it on one of the samples on the worksheet. Repeat this for the remaining samples on the worksheet. You can also assign detectors automatically by clicking on the **Auto-assign** button. To start data acquisition, click on **Start Now**. The worksheet will close, acquisition will start, and the sample entries you've just made in the wizard will be displayed up in the Batch Explorer Tree under *Background/All Samples/ABC Bkg 1*. In the right-hand column (the Sample Analysis Explorer) as soon as data acquisition begins on a sample, a spectrum record will be created for it. When analysis is complete, an analysis record will be displayed beneath each spectrum analyzed. Click on the spectrum record to display the spectrum in the Spectrum Window, and click on the analysis record to see the analysis ROIs and peak identifications superimposed on the spectrum.

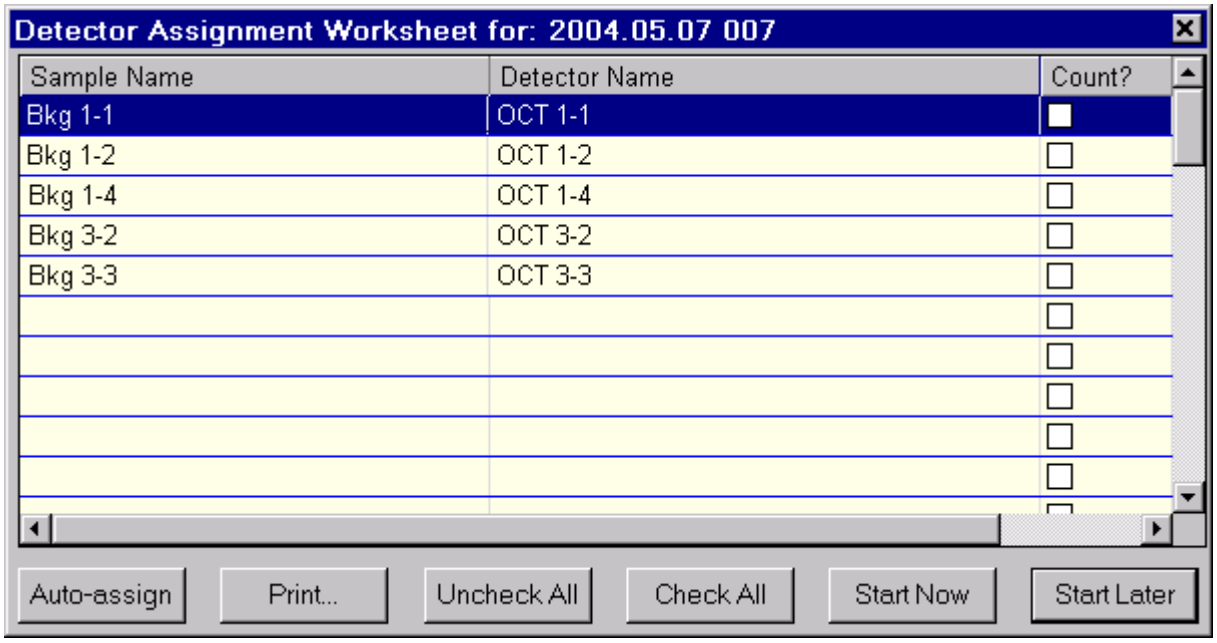


Fig. 161.

When acquisition and analysis are done, the Batch Explorer Panel will look like the accompanying illustration (Fig. 162).

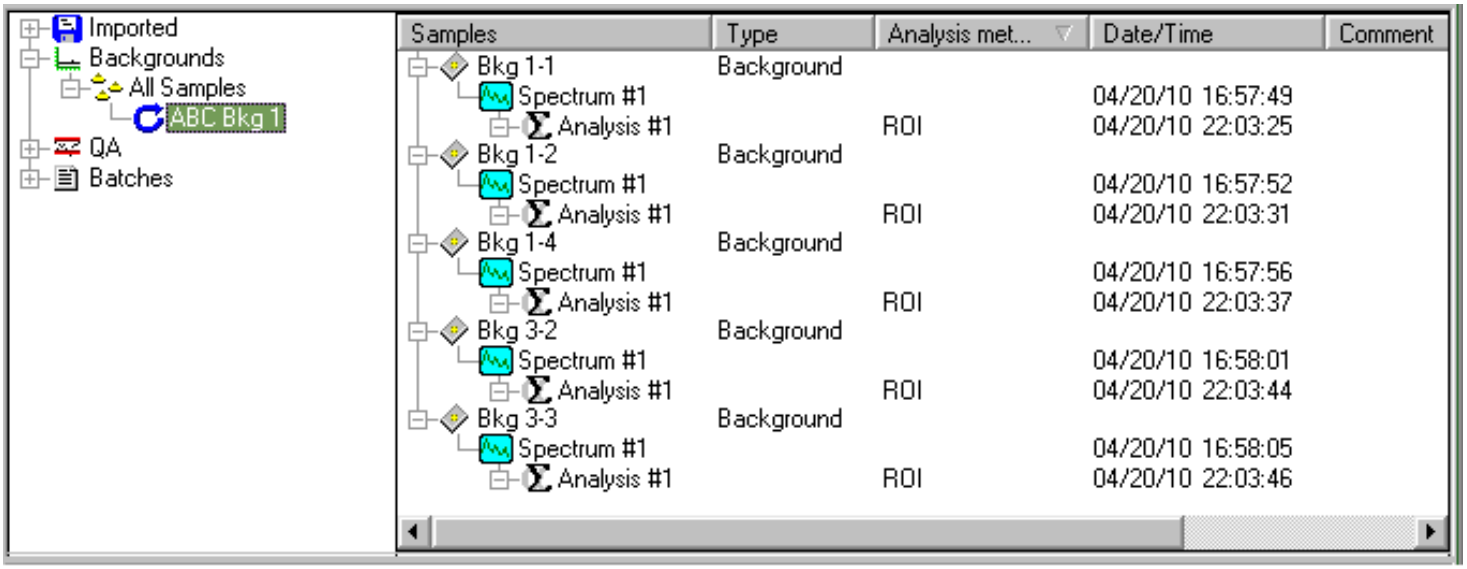


Fig. 162.

You’re now ready for the final step: tracking QA/QC.

5.1.7. Step 6 — Viewing and Reporting the Chemical Recovery QA/QC

QA tests are extremely fast and easy to run in AlphaVision v5.6. Control sample and reagent blank QA are performed automatically as each batch is analyzed. The remaining QA tests (except Pulser, which requires a brief data acquisition) are performed in QA mode from the **QA/Tests** submenu. Just click on the QA test name to evaluate all samples that have not yet been tested for that aspect of QA. AlphaVision then flags these records so they are not tested again.

Viewing the QA Control Charts is just as easy. Simply set up the control limits, then click on the Charts tab at the bottom of the QA/QC Panel and AlphaVision will generate your charts. Change the control limits, click back on the Charts view and AlphaVision will regenerate your charts to reflect the new limits.

Now that we have created a Tracer Set for our ^{242}Pu tracer, set up a Chemical Recovery QA Type to track the ^{242}Pu, and used both in counting our example batch of 5 samples, it's time to prepare QC charts to view the chemical recovery of our tracer solution.

1. On the Outlook Toolbar, select the **QA** icon. At the bottom of the QA Panel, make sure you're on the Limits view. Next, go to the top of the QA Panel and click on the Chemical Recovery tab.

2. In the list of Chemical Recovery types, select *ABC Pu242 CR*. Click on the **Chemical Recovery** checkbox so *ABC Pu242 CR* will be evaluated during the Chemical Recovery QA test that follows. Now enter the **Min**, **Low**, **High**, and **Max** control limits. When you are finished updating the limits, click on **Apply Changes** (Fig. 163).

3. Next, perform the QA test for Chemical Recovery. This will scan the AlphaVision database for all data records in which the *ABC Pu242 CR* QA Type has been used, locate those records that have not yet been QA tested (1 so far), and test them. From the menu bar, select the **QA/Tests/Chemical Recovery** (Fig. 164).

4. It is now time to view the Control Chart. Make sure *ABC Pu242 CR* is highlighted on the Limits view, then, at the bottom of the panel, click on the Chart view.

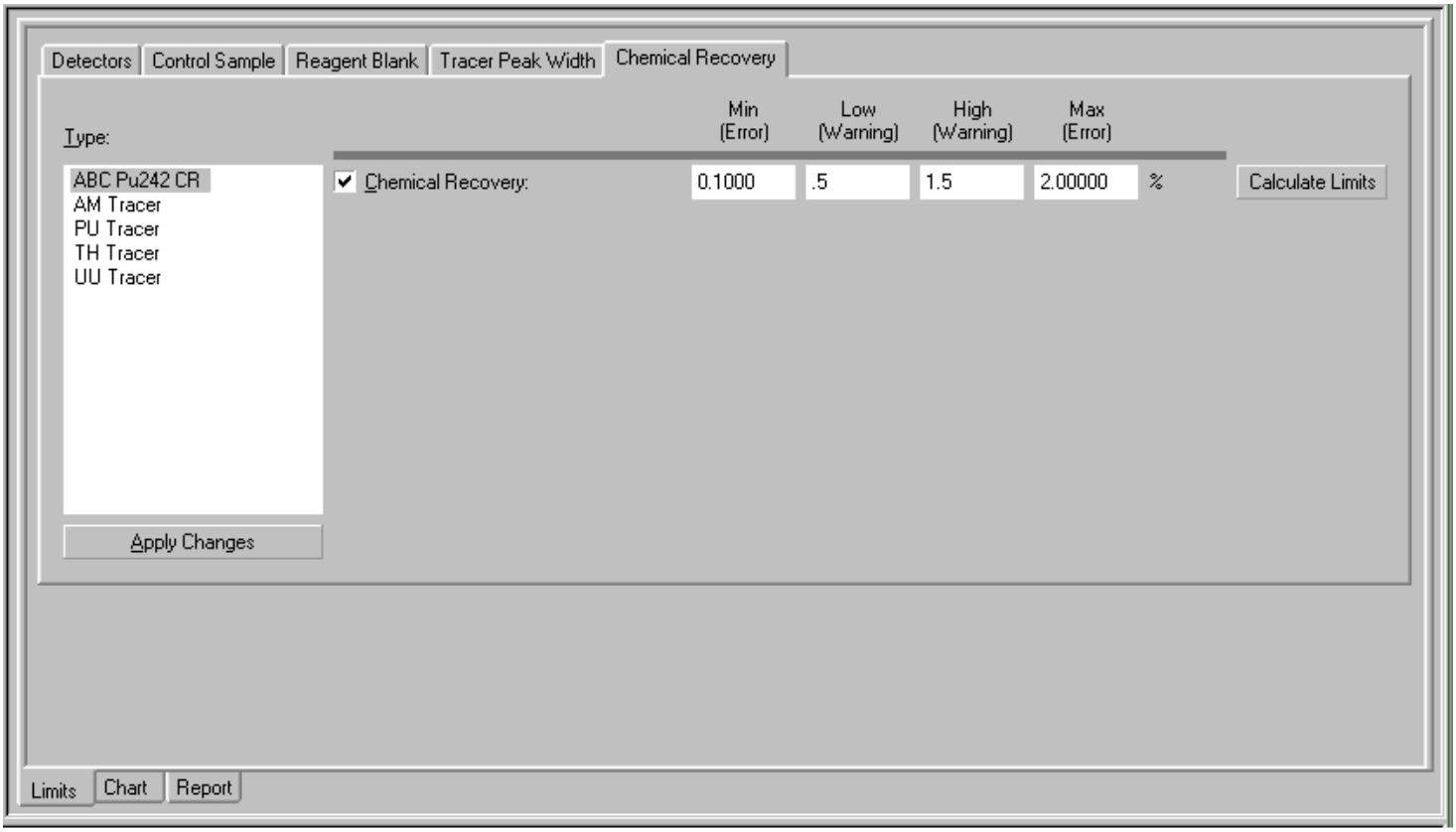


Fig. 163.

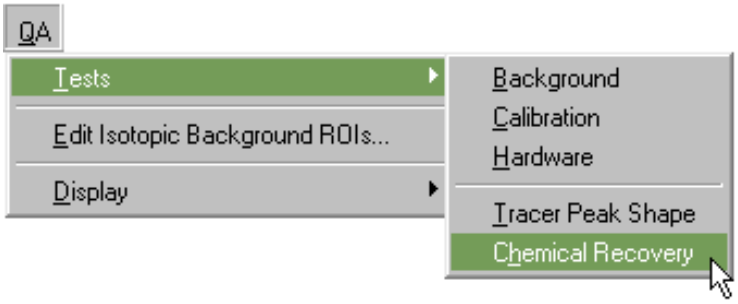


Fig. 164.

5. Next, choose the reporting interval for the QC Chart. From the menu bar, click on **QA/Display/Custom...**, and select a suitable time interval (e.g., **Weekly**, **Monthly**, etc.) from the submenu. We will use the last entry on the submenu, **Custom...**. It allows you to use the date tool to tailor the start and end dates for a Control Chart. In this example, we have chosen to display the Chemical Recoveries for ABC Soil Pu Analyses from *July 16, 2003* to *January 26, 2004* (Fig. 165).

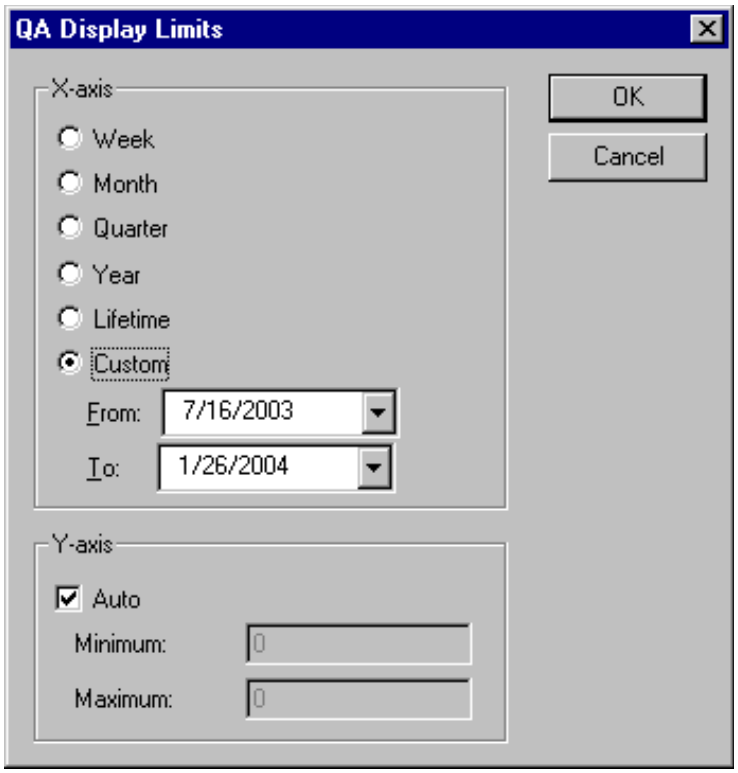


Fig. 165.

You can also either specify the **Minimum** and **Maximum** values of the **Y-axis** (which allows you to exclude outlying points) or allow the software to automatically set the scale.

When you set up the start and end dates and click on **OK**, the Control Chart will redisplay with your new reporting interval (Fig. 166).

5. To view the QA Report for this analysis, click on the Report view at the bottom of the QA/QC Panel. Use the scroll bar at the right of the Report Window to view the entire report. Click on the print button to print a copy of the Report (which shows the name of the QA parameter being reported, and includes the corresponding QC Chart and control limits).

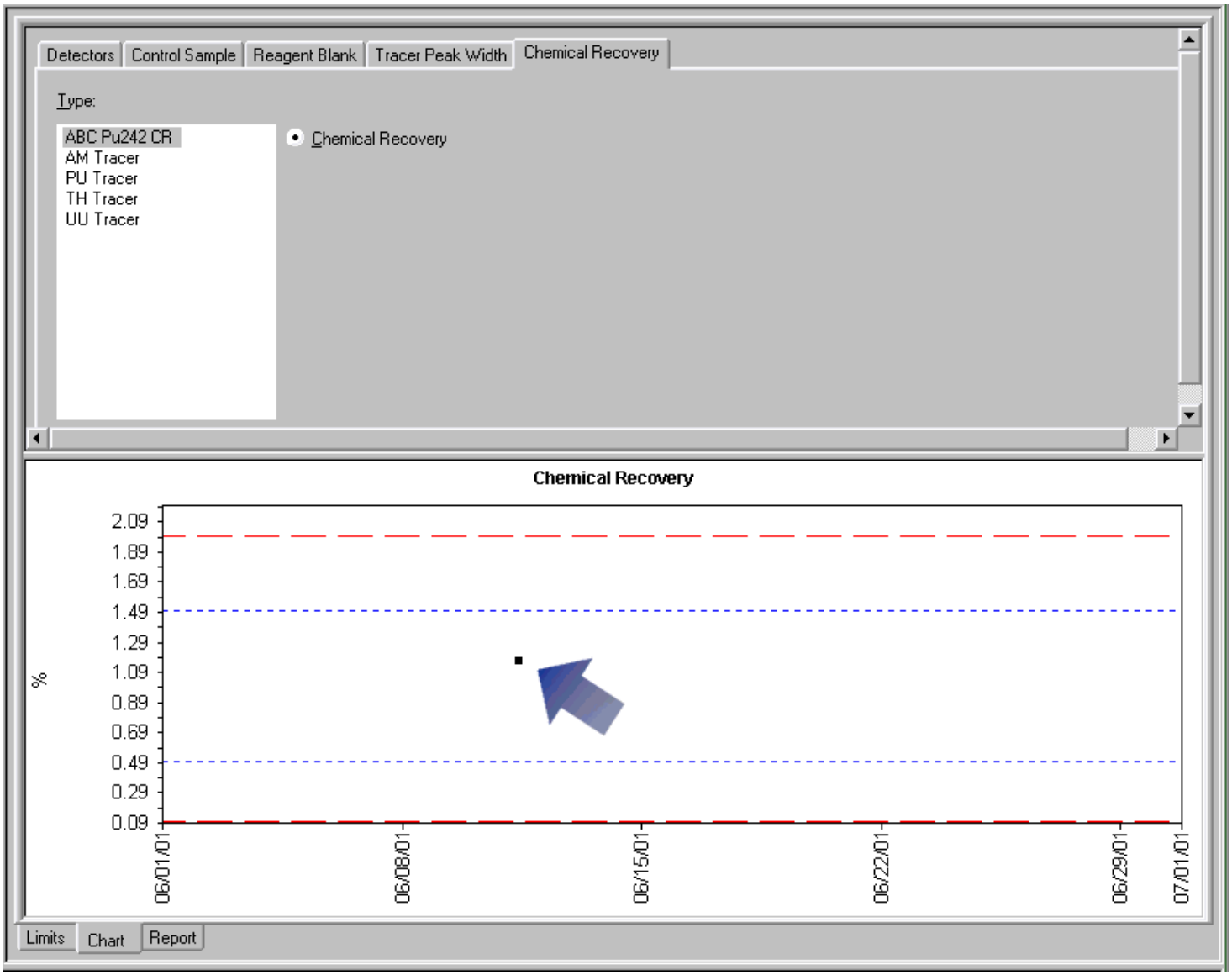


Fig. 166.

6. The steps for creating and viewing the other QC Charts and Reports are very similar to the ones covered here for Chemical Recovery.

****** This concludes the tutorial. Enjoy using AlphaVision v5.6! ******

6. BEFORE BATCHING IN ALPHAVISION v5.6

AlphaVision v5.6 gives you unprecedented flexibility and control over all aspects of alpha spectrometry. To exercise this power, you will need to set up some of the software features before you begin using AlphaVision for sample analysis. We assume here that, at minimum, you have installed and configured your hardware and software according to the *Installation Guide* and/or Chapter 2 of this manual; read Chapter 3 or ***Using the User Interface*** in the HTML Help Manual; and explored the features and menu commands in **Calibration**, **Batch**, **Hardware**, and **QA/QC** modes.

Security

- Create user access levels, if needed; and assign usernames and passwords.

Detectors

- Build a master list of available alpha chambers if this step was interrupted during software installation.
- Populate the Detector Grid with detectors from the Master List, assign each one a unique name (for QA tracking), and enter its properties from its accompanying data sheet.
- Assign QA limits for each detector.

Libraries and Other User-Defined Analysis Tools

- Create project- or nuclide-specific analysis libraries (this can also be done "as you go," during wizard setup).
- Create a calibration source library for each calibration standard.
- Create the records for control solutions.
- Set up Tracer Sets as needed (this can also be done during wizard setup).
- Set up calibration, analysis, background, and QA templates for your most common types of data acquisitions and geometries (this can also be done during wizard setup).

QA Setup

- Set up QA Types to define and create the names of the QC Charts you will need.
- Define control and specification limits for QA reports and charts (this can also be done later).
- Perform initial energy and efficiency calibrations on the detectors just assigned to the Detector Grid. This will mark the first appearance in the QA records of these detectors.

Establish Detector Backgrounds

- Detector backgrounds.
- Isotope-specific backgrounds.

Batch Explorer Panel

- In the Batch, Backgrounds, and QA sections of the Batch Explorer Tree, create a sample organization hierarchy that logically represents your projects and their tasks.

Interface Between Your LIMS and the AlphaVision v5.6 Database.

- Set up an interface between your LIMS and the AlphaVision v5.6 database if you wish. You may also wish to set up peak-search-and-fit records (although you can do this “as you go” in the Batch and Calibration Wizards). ROI records can be set up during calibration.

7. ANALYSIS METHODS

This chapter explains the AlphaVision v5.6 analysis calculations and how data the inputs are used.

AlphaVision v5.6 provides two main categories of spectral analysis tools:

- Peak and library-based search and fit
- Region-of-interest (ROI) analysis

Peak and library search-and-fit methods use mathematical algorithms to find peaks in the spectrum and "fit" the spectral data. In ROI analysis, you set specific channels to define the starting and ending points of regions of interest.

AlphaVision analyzes spectra and produces peak lists containing the backgrounds, activities, peak shape parameters, and ROIs for peaks found in the spectrum. Nuclides specified in the sample type but not found by the analysis program are also included in the resulting peak list. If a nuclide is identified by the analysis algorithm, the nuclide name, activity, critical level (L_c), and minimum detectable activity (MDA) are also included in the peak list.

In addition to the peak list, each analysis also generates a single record containing data common to the analysis as a whole. Items such as the energy calibration constants, sample volumes, hardware descriptions, and efficiencies are stored with the analysis data. The combination of a single analysis record and its associated peak list provides a complete history of the analysis.

The results of the analysis are stored in the AlphaVision database and can be exported in custom report formats; and saved in Microsoft Excel 8.0 **.XLS** format, as well as HTML 4.0, **.RTF**, **.TXT**, and Microsoft Word **.DOC** formats.

7.1. Peak Search

There are two peak-search algorithms to chose from: **Mariscotti 2nd Derivative** and **Top-Hat Correlation**.

7.1.1. Search Engine

7.1.1.1. Mariscotti Method

In the Mariscotti method,[4] the second derivatives of the spectrum are calculated according to Eq. (8) in the Mariscotti paper. The standard deviation of the second derivatives is calculated

[4]M.A. Mariscotti. "A Method for Automatic Identification of Peaks in the Presence of Background and its Application to Spectrum Analysis," *Nuclear Instruments and Methods* 50, 309–320 (1967).

according to Mariscotti Eq. (10) and multiplied by a weighting factor, the **Minimum Peak Sensitivity**, to yield the weighted error of the channel counts. The software finds a peak if the absolute value of the second derivative is greater than the weighted error for more than 3 consecutive data points.

The **Minimum Peak Sensitivity** factor can be set from 1.0 to 10 in increments of 0.5. Low values will find small peaks but may also cause the program to accept some false peaks. High values will locate large peaks but will miss some small peaks. For a Mariscotti search, a sensitivity setting of 4 or higher will find well-defined peaks. A setting of 6 is a good starting point for the **Top-Hat Correlation**. A rule of thumb is to collect at least 100 counts to obtain a "well-defined" peak. However, with some experience, you can quantify and fit much smaller peaks.

To further refine the peak fitting parameters you can also enter an **Expected "Gaussian" Width** in channels for the peak (denoted here as W_g), and its **Expected Gaussian Uncertainty** in channels (denoted as ΔW_g). If the peak width found is W_f, the peak is validated if:

$$|W_f - W_g| \leq \Delta W_g \quad \textbf{(1)}$$

7.1.1.2. Top-Hat Correlation

For the Top-Hat Correlation, AlphaVision uses a zero-area top-hat filter.[5] You must enter an **Expected "Gaussian" Width** for the peak (which, for best results, should be within 10-30% of the actual FWHM). This peak width value is used to calculate a correlation factor, F_{corr}, and the background. If the standard deviation of the background is STD_{bkg} and the **Minimum Peak Sensitivity** is SENS, the software finds a peak if:

$$F_{corr} \geq SENS * STD_{bkg} \quad \textbf{(2)}$$

Since the peak width is known *a priori*, there is no need to use **Eq. (1)** to check the width.

For both methods, W_g is the estimated Gaussian width of the peak. Because alpha peaks have long tails on the low-energy side, W_g is best estimated from the high-energy side of the peaks since the high-energy side of the peak can be fitted rather well with a Gaussian function.

[5]K. Debertin and R.G. Helmer. *Gamma- and X-Ray Spectrometry with Semiconductor Detectors*, Elsevier Science, 1988.

7.1.2. Spectrum Processing

7.1.2.1. Spectrum Smoothing

The Savitzky-Golay algorithm[6] is used to smooth the spectrum before the peak search.

7.1.2.2. Cubic Spline Data Interpolation

The main characteristic of the cubic spline method[7] is that it ensures the continuity of the first and second derivatives of the extrapolated curves. By default, if the original spectrum contains 1024 channels or less, the spectrum will be extrapolated to 2048 data points. This helps to better define the peak shape and thus improve the success of peak search and fit.

7.2. Peak Fit

7.2.1. ORTEC Algorithm

The **ORTEC Algorithm** fit function is given by:

$$Y_f(E_i) = p_1 e^{p_2 E_i} \, erfc\left[p_3(E_i + p_2/2p_3 - p_4)\right] \quad \textbf{(3)}$$

where p_1 through p_4 are fit parameters, E_i is the energy at channel i, and *erfc* is the complimentary error function.[8] This function is derived by convoluting an exponential tail function with a Gaussian function. The task of all minimization methods is to find the best possible set of parameters p_1 to p_4 such that the function Y_f can best represent the measured counts throughout the spectrum.

[6]Bromba, M.U.A. and Horst Ziegler. "Application Hints for Savitzky-Golay Digital Smoothing Filters," *Anal. Chem.* 53, 1583-1586 (1981).

[7]Press, W.H. et al. *Numerical Recipes in C — The Art of Scientific Computing,* 2nd Ed., Cambridge University Press, Cambridge, 113-117 (1992).

[8]ibid., 220.

7.2.2. Minimization Method

7.2.2.1. Chi-Square

In this method, the peak fit routine tries to minimize the following quantity F:

$$F = \sum_{i=1}^{N} \frac{(Y_f(E_i) - Y_i)^2}{S_i^2} \quad \textbf{(4)}$$

where:

Y_i = the counts at channel i
$Yf(E_i)$ = the counts of the calculated value at energy E_i
S_i = the standard deviation of Y_i, which is $S_i = \sqrt{Y_i}$
N = the total number of channels

F is the *chi-square* of the fit.

7.2.2.2. Relative Deviation

In the relative deviation method, F is defined as:

$$F = \sum_{i=1}^{N} \frac{|Y_f(E_i) - Y_i|}{S_i}$$

where:

Y_i = the actual counts at channel i
$Yf(E_i)$ = the value calculated by the fit function at energy E_i
S_i = the standard deviation of Y_i, which is $S_i = \sqrt{Y_i}$
N = the total number of channels

Upon a successful fit, the F value defined in **Eq.(3)** is minimized.

7.2.2.3. Residuals

In this method, F is defined as:

$$F = \sum_{i=1}^{N} | Y_f(E_i) - Y_i | \quad \textbf{(8)}$$

where:

Y_i = the actual counts at channel i
$Y_f(E_i)$ = the value calculated by the fit function at energy E_i
S_i = the standard deviation of Y_i
N = the total number of channels

In this minimization method, the routine tries to minimize the difference at each data point between the fitted value and the measured counts. That is, the sum of absolute residuals are minimized.

The **Chi-Square** method is the widely accepted method. You may wish to use the **Relative Deviation** or **Residuals** methods if the spectrum contains badly overlapping peaks.

7.2.3. Advanced Fit Control Parameters

In the Marquardt nonlinear fitting method (adapted according to Press et al.[9]), the fitting is done in an iterative process. The user-entered maximum number of iterations (**Max Iterations** on the Peak Fit dialog) controls the maximum number of loops to iterate (to find the minimum value of F in **Eq. [4]**, **[5]**, and **[6]**).

AlphaVision uses results obtained from the peak search to calculate initial values of p_1 through p_4 and, hence, an initial F value. Then, based on the minimization method selected, the Lavenberg-Marquardt method is used to change fit parameters p_1 through p_4 and calculate another F value. In each iterative calculation, the F value of the current run is compared with the previous one. The fitting is done (or converges) if this difference is less than a user-defined value, ε, as follows:

$$| F(j) - F(j-1) | < \varepsilon \quad \textbf{(9)}$$

[9]Press, W.H. et al. *Numerical Recipes in C — The Art of Scientific Computing*, 2nd Ed., Cambridge University Press, Cambridge, 633-683 (1992).

where:

F(j) = the F value calculated after the j^{th} iteration
F(j-1) = the F value of the previous iteration
ε = the precision desired

For the **Chi-Square** minimization method (**Eq. [4]**), ε is user-defined in the **Fit Precision** field on the Peak Fit dialog (in this case, the fit precision is the chi-square precision). Since the chi-square value should be approximately 1.0, a value of 0.01 or 0.001 should be adequate.

If the **Relative Deviation** method (**Eq. [5]**) is used, the value in the **Fit Precision** field is the precision of the total relative deviation desired, and roughly the same values can be used here as for **Chi-Square** minimization.

However, for the **Residuals** method (**Eq. [6]**), the value in the **Fit Precision** field is the precision of absolute residuals desired. In this case, the precision desired should depend on the total counts of the peaks. A value between 1% to 0.1% of the total counts in each peak is adequate.

The dimensionless **Initial Lamda** and **Lamda Multiplier** values control how "quickly" the Marquardt routine adjusts its fitting parameters (which are the parameters in the fit function, **Eq. [3]**) from one iteration to the next. The default values are suitable for most applications. If peak fit fails, we suggest that you adjust the peak search parameters or the **Max Iterations** and **Fit Precision** before trying to adjust **Initial Lamda** and **Lamda Multiplier**.

7.2.4. Fit Acceptance Limits

The program verifies the validity of the peak fit according to the criteria you have entered. If you are using the **Relative Deviation** method, a maximum chi-square value (**Maximumc^2 of Fit**) is used. If the chi-square value for the fit exceeds that value, the fit to that peak (or peaks) is not valid and no fitted values are calculated for that peak. After fitting, the fit routine not only finds the values for p_1 through p_4, but also calculates the uncertainties of p_1 through p_4, denoted as Δp_1 through Δp_4. If the percentage uncertainty ($\Delta p_1/p_1 * 100$ and so forth) exceeds the user-entered **Maximum Uncertainty**, the fit is invalid.

You can also enter the **Expected (Fitted) Peak FWHM** value, denoted here as $FWHM_{exp}$, and the **Expected Peak FWHM Uncertainty**, denoted as ΔFWHM. For each fitted peak, if the calculated peak FWHM is $FWHM_i$, then a valid peak must meet the following criterion:

$$|FWHM_i - FWHM_{exp}| \leq \Delta FWHM \quad \textbf{(10)}$$

Finally, the fit routine calculates the peak start channel, ch_1, and end channel, ch_2, and then integrates the gross counts between ch_1 and ch_2 to obtain the sum of the measured counts from ch_1 to ch_2. ch_1 is calculated as 5 × FWHM on the low-energy side of the centroid. ch_2 is calculated as 3 × FWHM on the high-energy side of the centroid.

If the calculated peak area is A (see "ORTEC Algorithm," Section 7.2.1), then the percent difference between A and the gross counts should be less than the user-defined percent area difference for valid peaks (the **Maximum Area Difference**). This is a very coarse check since there is no algorithm that can unequivocally determine a peak's start and end channels. Therefore, the **Expected Peak FWHM Uncertainty** should not be set too small.

7.3. Analyze Stripped Spectrum (Residuals)

This option is meaningful only for ROI analyses. For the residual spectrum, the residual counts in channel i are calculated as:

$$R_i = Y_i - Y_f(E_i) \quad \textbf{(11)}$$

where the fit function $Y_f(E_i)$ is described in **Eq. (3)**.

In ROI analysis, if analyze residuals is desired, the program will do a peak search and fit, and calculate the residual spectrum from **Eq. (9)**. This residual spectrum will then be used instead of the original spectrum to calculate activities in the ROIs.

7.4. Adjust ROI Width

If you choose to automatically adjust the width of ROIs according to the calculated tracer peak FWHM (by marking the **Width** checkbox in the **Adjust ROIs** section on the Batch Wizard's Analysis Setup page), the change in FWHM of the tracer peak is calculated as:

$$\Delta FWHM = FWHM_{exp} - FWHM_{meas} \quad \textbf{(12)}$$

where:

$FWHM_{meas}$ = the actual FWHM of the tracer peak

$FWHM_{exp}$ = the expected FWHM value of the tracer peak as entered in the **Expected Tracer FWHM** field on the Tracer Editor dialog

If an ROI is defined with a start channel ch_1 and an end channel ch_2, the new adjusted values are:

$$ch_{1_{adj}} = ch_1 - \Delta FWHM/2$$
$$ch_{2_{adj}} = ch_2 - \Delta FWHM/2 \quad \textbf{(13)}$$

To adjust the ROI width, the analysis engine first performs a peak search and fit to find the tracer peak. Once the tracer peak has been identified and fitted, its FWHM can be calculated ($FWHM_{exp}$ in **Eq. [12]**).

7.5. Partial Channel Correction

If the count value at channel ch_1 is c_1 and the count value at channel ch_2 is c_2, a "partial" channel with a non-integer channel number of x where $ch_1 < x < ch_2$, has interpolated counts according to the following calculation:

$$C_x = c_1 + (c_2 - c_1) * (x - ch_1) \quad \textbf{(14)}$$

If an ROI contains partial channels but you have not chosen to **Correct Partial Channels**, the counts at channel x are calculated as follows:

$$C_x = c_1 \qquad if\ x < ch_1 + 0.5$$
$$C_x = c_2 \qquad if\ x \geq ch_1 + 0.5 \quad \textbf{(15)}$$

7.6. Region-of-Interest Analysis

A region-of-interest analysis integrates the net counts over a specified region in the spectrum and works best with well-separated peaks. The net counts are determined using **Eq. (17)** for an absolute analysis or **Eqs. (19)** or **(20)** for an analysis relative to a tracer. These regions are specified in the ROI Records. You can specify the regions in one of two ways:

7.6.1. Adjusted Channels

In a relative analysis, the ROI channels can be adjusted in 2 ways. If you mark the **Recalibrate** checkbox, AlphaVision performs a peak search and fit to find the tracer peak first. The ROI centroid energies are then shifted by the same amount that the calibrated tracer peak energy has shifted. These ROI widths, however, are adjusted only if you mark the **Width** box in the **Adjust ROIs** section of the Analysis Setup page within the Batch Wizard. When you mark **Width**, the

ROIs are adjusted according to the ratio between the actual tracer peak and the **Expected Tracer FWHM** entered for the Tracer Set you are using.

To perform an "adjusted channels" ROI analysis, mark the **Width** and **Recalibrate** checkboxes on the Analysis Setup page of the Batch Wizard, and under **Recalibrate**, choose **Adjust Gain** or **Adjust Offset**. **Adjust Gain** and **Adjust Offset** allow you to correct for peak shifts in alpha spectra. The software uses the peak position of the tracer (and the library energy for the tracer peak) to determine if a shift in the energy of the peak has occurred. If you have selected, **Adjust Offset**, AlphaVision adjusts the offset term in the calibration equation to reflect the shift in the tracer peak; this adjusts all other peaks in the spectrum as well. If you have selected **Adjust Gain**, the software adjusts the gain term in the calibration equation to reflect the shift in the tracer peak position.

7.6.2. Absolute Channels

The ROI is entered as absolute channel numbers and are not adjusted if a recalibration is performed. To perform an "absolute channels" ROI analysis, leave the **Width** and **Recalibrate** checkboxes *unmarked*.

7.7. Calculations for Absolute and Relative Analysis

7.7.1. Dilution Scaling Factor

The dilution scaling factor is used in determining nuclide activity, chemical recovery, and MDA. The algorithm for calculating this factor differs according to whether you use the **Total** sample, an **Aliquot** of the sample, or an aliquot taken after one or two **Dilution**s of the sample. These choices are made on the Sample Properties page of the Batch Wizard (see Section 1.5.3).

- When using the **Total** sample, the dilution scaling factor is *1* (one).
- For an **Aliquot** of the total sample, the dilution scaling factor is *[Total sample size / Aliquot size]*.
- The following equation is used for **Dilution**s.

$$DILUTION\ SCALING\ FACTOR = D_1/A_1 \times D_2/A_2 \qquad \textbf{(16)}$$

where

D_1 = Volume of dilution *1*
A_1 = Volume of aliquot *1*

Nuclide activity, chemical recovery, and MDA are then expressed on the report as activity per sample or activity concentration (normalized per unit of measure), according to the choice on the Analysis Setup page of the Batch Wizard.

7.7.2. Dilution Calculation in Batch Wizard

The **Dilution** feature on the Sample Properties page of the Batch Wizard (see Section 1.5.3) supports two stages of dilutions and aliquots, uses the following algorithm.

$$DILUTION\ FACTOR = \frac{D_1/A_1 \times D_2/A_2}{Sample\ size} \quad \textbf{(17)}$$

where

D_1 = Volume of dilution *1*
A_1 = Volume of aliquot *1*
Sample size = Sample volume or weight

7.7.3. Gross Counts

The gross counts for a specific nuclide using an ROI analysis are calculated as follows:

$$Cnt_g = \sum_{i=s}^{e} Cnt_i \quad \textbf{(18)}$$

where:

Cnt_g = gross count for nuclide
Cnt_i = count in channel i
e = end channel for ROI in the spectrum
s = start channel for ROI in the spectrum

The gross counts for a specific nuclide using a peak fit analysis are calculated as follows:

$$Cnt_g = \int_0^{\infty} Y_f(E)\, dE \quad \textbf{(19)}$$

where:

$Y_f(E)$ = calculated count in energy E from **Eq. (3)**.

7.7.4. Background

The background counts for a specific nuclide using an ROI analysis or peak-fit analysis are calculated as follows:

$$Cnt_b = \sum_{i=s_b}^{e_b} Cnt_i \quad \textbf{(20)}$$

where:

Cnt_b = background count for nuclide
Cnt_i = count in background channel i
e_b = end channel for ROI in the background or calculated end channel from peak search and fit
s_b = start channel for ROI in the background or calculated start channel from peak search and fit

In a peak search and fit, the start channel, s_b, and end channel, e_b, are calculated as:

$$s_b = Peak\ centroid - 5W_L$$

$$e_b = Peak\ centroid + 3W_H$$

where:

W_L = peak width of the low-energy side
W_H = peak width of the high-energy side

The reported background counts are scaled by T_s/T_b, where T_s is the sample count time and T_b is the background count time.

7.7.5. Net Counts

7.7.5.1. Absolute

The net counts for a specific nuclide are calculated as:

$$Cnt_n = Cnt_g - Cnt_b \cdot \frac{T_s}{T_b} \quad \textbf{(21)}$$

where:

Cnt_n = net counts for nuclide
T_s = live time of sample in minutes
T_b = live time of background in minutes

The net counts per minute are calculated as:

$$CPM_n = \frac{Cnt_n}{T_s} \quad \textbf{(22)}$$

where:

CPM_n = net counts per minute for a nuclide

7.7.5.2. Relative to Tracer

In a relative analysis, the net counts for a specific nuclide are calculated as in **Eq. (21)**. If the tracer has a contaminant specified, the net counts for a specific nuclide (affected by the contaminant) are calculated as follows:

$$Cnt_n = Cnt_g - Cnt_b \cdot \frac{T_s}{T_b} - \frac{Pc_N \cdot Cnt_{tr}}{100} \quad \textbf{(23)}$$

where:

Pc_N = percent contamination for nuclide N
Cnt_{tr} = net counts in tracer peak (from **Eq. [20]**)

Once the net count has been determined, the net counts per minute can be calculated according to **Eq. (18)**. The contaminant counts are also decay corrected.

7.7.6. Decay-Corrected Net Counts

If the acquisition and reference times are different, the decay-corrected net counts per minute are calculated as follows:

$$CPM_d = \frac{Cnt_n}{T_s} \cdot e^{\left(\frac{T_e \cdot \ln(2)}{T_h}\right)} \quad \textbf{(24)}$$

where:

T_e = elapsed time (acquired minus reference) in minutes
T_h = nuclide half-life, in minutes

7.7.7. Counting Uncertainty

Counting uncertainty, σ, is expressed as:

$$\sigma = \sqrt{C},\ C>0$$
$$\sigma = 1,\quad C=0 \qquad \textbf{(25)}$$

where C is the number of counts.

7.7.8. Total Efficiency in Absolute Analysis

When an absolute analysis is used, no chemical recovery (Cr) is computed. The total efficiency is equal to the efficiency of the detector times the Manual Chemical Recovery, *Mcr*.

$$Ef_t = Ef_d \cdot Mcr \qquad \textbf{(26)}$$

where:

Ef_t = total efficiency
Ef_d = detector efficiency
Mcr = Manual Chemical Recovery

7.7.9. Total Efficiency in Analysis Relative to Tracer

7.7.9.1. Chemical Recovery

For a relative analysis, the Chemical Recovery (Cr) is computed next. The total efficiency of the system is equal to the efficiency of the Detector multiplied by the Chemical Recovery and Manual Chemical Recovery. The following equation is used to calculate the Chemical Recovery for a relative analysis with tracer added to aliquot:

$$Cr = \frac{\frac{CPM_{tr}}{Ef_d \cdot Br_E}}{DPM_e} \qquad \textbf{(27)}$$

where:

Cr = chemical recovery
CPM_{tr} = net counts per minute for the tracer
DPM_e = disintegrations per minute expected for the tracer
Br_E = branching ratio for the tracer nuclide

The following equation is used to compute the Chemical Recovery for a relative analysis with tracer added to total:

$$Cr = \frac{\frac{CPM_{tr}}{Ef_d \cdot Br_E}}{DPM_e} \cdot DILUTION\ SCALING\ FACTOR \quad \textbf{(28)}$$

where *DILUTION FACTOR* is defined according to Section 7.7.1.

7.7.9.2. Total Efficiency Calculation

After the Chemical Recovery is determined in a relative analysis, the total efficiency of the system is computed using the following equation:

$$Ef_t = Ef_d \cdot Cr \quad \textbf{(29)}$$

where:

Ef_t = total efficiency
Ef_d = detector efficiency
Cr = manual chemical recovery

7.7.10. Nuclide Activity

The activity for a specific nuclide is calculated as follows:

$$DPM_n = \frac{CPM_d}{Ef_t \cdot Br_E} \quad \textbf{(30)}$$

where:

DPM_n = disintegrations per minute computed for the nuclide
Br_E = branching ratio for alpha energy E

7.7.11. Minimum Detectable Activity (MDA)

7.7.11.1. ANSI Standard

In the **ANSI Standard** method[10], the MDA is calculated as:

$$MDA = \frac{k_\alpha^2 / T_s + (2k_\beta \sqrt{\mu}) / T_b}{Ef_t * Br} \quad \textbf{(31)}$$

where:

Ef_t = total detector efficiency
T_s = sample live time
T_b = blank count time or background count time (live time)
Br = branching ratio, taken from the nuclide library
μ = variance
k_α = confidence level (**K_Alpha** on the MDA Setup screen in the Batch Wizard) for Type I error
k_β = confidence level (**K_Beta** on the MDA Setup screen in the Batch Wizard) for Type II error
V = sample volume or mass
Cr = chemical recovery

For a one-sided confidence level at 95%, k = 1.645. This is the default value, however, you can enter a different value. If a value of k = 1.645 is used, **Eq. (27)** is the calculation defined by ANSI. The variance, μ, differs depending on the **MDA Source Type** you have selected. The calculation for μ is:

$$\mu = G_b * (1 + T_b / T_s) \quad \textbf{(32)}$$

where:

G_b = blank sample counts or background counts in the region

The blank counts or the background counts should not be scaled by the count time of the sample.

[10]ANSI N13.30, *Performance Criteria for Radiobioassay*, American National Standards Institute, 1996.

7.7.11.2. General (Currie's Equation)

If you choose **General (Currie's Equation)**, the MDA is calculated as:

$$MDA = \frac{L_d}{Ef_t * Br * T_s} \quad \textbf{(33)}$$

where L_d is the detection limit, in counts, defined as:

$$L_d = L_c + \frac{k_\beta^2}{2}\left(1 + \left(1 + \frac{4L_c}{k_\beta^2} + \frac{4L_c^2}{k_\alpha^2 k_\beta^2}\right)^{1/2}\right) \quad \textbf{(34)}$$

k_α and k_β are confidence level factors for Type I and Type II error, respectively.[11] In this case, you can enter both k_α and k_β independently as confidence level parameters on the MDA Setup screen in the Batch Wizard (**K_Alpha** and **K_Beta**, respectively). If $k_\alpha = k_\beta$, Currie's equation reduces to the ANSI standard equation for paired observations (i.e., when the live time for the background spectrum is the same as that for the analysis spectrum).

L_c is the critical level, in counts, which establishes a statistical lower limit above which one may conclude that a signal has been detected. It is calculated as follows:

$$L_c = \frac{k_\alpha * \sqrt{\mu} * T_s}{T_b}$$

where μ = the background or blank variance in the ROI as defined in **Eqn. (32)**.

7.7.11.3. Total MDA

$$TOTAL\ MDA = MDA \times DILUTION\ SCALING\ FACTOR \quad \textbf{(35)}$$

where *DILUTION SCALING FACTOR* is defined according to Section 7.7.1.

[11]L. A. Currie. "Limits for Qualitative Detection and Quantitative Determination — Application to Radiochemistry," *Analytical Chemistry* 40(3), 586-593, March 1968.

7.7.12. Error Propagation

AlphaVision 5 enables you to include an uncertainty term for all measured values. These uncertainty terms are used to calculate uncertainties as follows for any calculated quantity of x. Suppose we want to determine a quantity x that is a function of parameters u, v, ... :

$$x = f(u,v,\ldots)$$

If the uncertainties of those parameters are σ_u, σ_v, ..., then the propagated uncertainty of the calculated value x is given as follows:[12,13]

$$\sigma_x^2 = \left(\frac{\partial f}{\partial u}\right)^2 \sigma_u^2 + \left(\frac{\partial f}{\partial v}\right)^2 \sigma_v^2 + \ldots \quad \textbf{(36)}$$

In the above equation the parameters u, v, ..., are assumed to be independent of each other. If x is a linear function of u, v, ..., (i.e., uses only addition, subtraction, multiplication, and division operators), the equation reduces to the familiar form, the addition of quadratures of individual uncertainties,[14] which is used by AlphaVision v5.6 (and was also used in AlphaVision v. 4).

7.7.12.1. Total Propagated Uncertainty (TPU) Calculation

The report provides the total propagated uncertainty (TPU) based on the uncertainty terms for all measured values in an analysis. These values plus additional **Random Uncertainty** and additional **Systematic Uncertainty** (on the Analysis Misc. screen of the Batch Wizard), are all included in the total propagated uncertainties calculation (**TPU Calculation**; see also footnote 14):

$$TPU = \sqrt{\sigma_a^2 + \sigma_r^2 + \sigma_s^2} \quad \textbf{(37)}$$

[12]Bevington, Philip R. and D. K. Robinson. *Data reduction and error analysis for the physical sciences*, 2nd ed., McGraw-Hill, 1992.

[13]Knoll, Glenn. *Radiation Detection and Measurement*, 2nd ed., Wiley & Sons, Inc., 1989.

[14]NIST Technical Note 1297, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, National Institute of Standards and Technology, 1994.

where:

σ_a = activity uncertainty
σ_r = | random uncertainty | in activity units
σ_s = | systematic uncertainty | in activity units

7.7.12.2. Subtract Net Blank Activity

$$Activity_{Final} = Activity_{Sample} - Activity_{Blank} \quad \textbf{(38)}$$

Results are converted to the requested units as appropriate.

For each nuclide, the absolute random and absolute total uncertainties are given by the following equation.

$$\sigma_{Final} = \sqrt{\sigma_{Sample}^2 + \sigma_{Blank}^2} \quad \textbf{(39)}$$

The MDA for each nuclide is based on the corresponding detection limit for the blank and yields for both blank and sample.

$$MDA = \frac{(MDA_{Blank})(Cr_{Blank})}{Cr_{Sample}} \quad \textbf{(40)}$$

where Cr = chemical recovery.

7.8. QA Limits Calculation

For a set of *N* QA values, the averaged value is calculated from:

$$V_a = \sum \frac{V_i}{N} \quad \textbf{(41)}$$

The standard deviation is calculated from:

$$STD = \sqrt{\sum \frac{(V_i - V_a)^2}{(N-1)}} \quad \textbf{(42)}$$

The QA limits are :

Minimum = $V_a - 3STD$

Low = $V_a - 2STD$

High = $V_a + 2STD$

Maximum = $V_a + 3STD$

APPENDIX A. DATA EXPORT EXAMPLE IN VISUAL BASIC

A.1. Introduction

Although the AlphaVision v5.x report templates are powerful tools for reporting on individual samples, as part of streamlining high-production operations, you might need to export complete sets of data and information to your LIMS or create electronic deliverables. This appendix tells you how to create a customized table of results for electronic summary of analysis results. You can customize report formats and manipulate data that you send to your LIMS. The following example program creates a Microsoft Excel® spreadsheet containing typical data that would be important for an export function in your lab. The important variables, assumptions, and requirements are documented. An electronic version is found in the **\Example Code** folder on the installation CD.

This appendix gives you an example program in Microsoft Visual Basic 6 SP5 that can be used to automate the creation of summary report tables of analysis results for batches of samples analyzed using AlphaVision v5.6. The program exports a batch of samples, with reporting criteria set to report in activity per unit volume and express uncertainty in percent.

A.2. System/Software Requirements

This example assumes that you have some knowledge of Visual Basic, and is not intended as a Visual Basic tutorial. However, if your goal is to learn Visual Basic to work with the AlphaVision database, this tutorial can be used as a learning tool to help you create your first electronic summary report.

The program requires that you have the **AlphaVisionDemo.mdb** database installed with the AlphaVision v5.6 software in **c:\Program Files\Ortec\AlphaVision 5\AlphaVisionDemo.mdb** (or the location you selected within the install wizard).

A.2.1. Development Environment, Components and References

The program was developed using:

- Microsoft Windows XP Professional
- Microsoft Office 2002
- Visual Basic 6 SP5

Components:

- None

References:

- Microsoft Visual Basic for Applications
- Microsoft Visual Basic Runtime Objects and Procedures
- OLE Automation
- Microsoft DAO 3.6 Object Library
- Microsoft Excel 10.0 Object Library

A.3. Program and Documentation

The program is cut and pasted from the single form application. It is designed to allow you to export the demonstration batch **Pu_Demo_Batch** to a Microsoft Excel spreadsheet. The program can be easily adapted to create a text file (or other) output. Number formats, fonts, and other flourishes can also be added. In this documentation, the program contains text comments that provide insights on important variables, data types, and fields in the AlphaVision database. A streamlined version, **vbExportCode.doc**, is located in the **\Example Code** folder on the installation CD.

A.3.1. Form Load Event

The form load event loads a list box with all of the batches in the database where the following conditions are met:

AnalysisResults.Archive = 0
AlphaVision archives previous analysis when you Update an analysis, i.e., it preserves the record in the database and creates a new updated analysis. The **AnalysisResults.Archive** field flag is set to True (–1) for archived analyses. To get the most recent updated analysis, set your criteria to 0 (zero) for this field.

Sample.Type < 3
There are five “types” in the Sample table:

0 = Sample
1 = Blank
2 = Control
3 = Background
4 = Pulser

By setting criteria “<3” in the Form_Load event query, you are filtering out Backgrounds and Pulsers.

```
'Form Load Event

Private Sub Form_Load()

'change the mouse pointer to an hourglass while
'the batches are loading

Screen.MousePointer = vbHourglass

'this code creates a list of Batches in the lstBatchName list

    Dim db As Database
    Dim rs As Recordset
    Dim sql As String

sql = "SELECT DISTINCT JobSpec.JobSpecName, AnalysisResults.Archive " & _
        "FROM Tracer INNER JOIN ((((Sample INNER JOIN Spectra " & _
        "ON Sample.SampleID = Spectra.SampleID) " & _
        "INNER JOIN (AnalysisSpec INNER JOIN JobSpec " & _
        "ON AnalysisSpec.AnalysisSpecID = JobSpec.AnalysisSpecID) " & _
        "ON Sample.BatchID = JobSpec.BatchID) " & _
        "INNER JOIN HWParameters ON Spectra.HWParametersID = " & _
        "HWParameters.HWParametersID) INNER JOIN (AnalysisResults " & _
        "INNER JOIN AnalysisDetails ON AnalysisResults.AnalysisResultsID = " & _
        "AnalysisDetails.AnalysisResultsID) " & _
        "ON (Spectra.SpectrumID = AnalysisResults.SpectrumID) " & _
        "AND (AnalysisSpec.AnalysisSpecID = AnalysisResults.AnalysisSpecID)) " & _
        "ON Tracer.TracerRecordID = AnalysisSpec.TracerRecordID " & _
        " "WHERE (((AnalysisResults.Archive)=0)) AND Sample.Type < 3"

    Set db = OpenDatabase("c:\Program Files\Ortec\AlphaVision 5\AlphaVisionDemo.mdb")

    Set rs = db.OpenRecordset(sql, dbOpenDynaset, dbReadOnly)

    Dim cnt As Integer
    cnt = 0

    Dim strPre As String
    Dim strCur As String

    lstBatchName.Clear
    While Not rs.EOF

        strCur = rs(0)
        If strPre <> strCur Then
            lstBatchName.AddItem strCur
            strPre = strCur
        End If
        rs.MoveNext
        cnt = cnt + 1
    Wend

Screen.MousePointer = vbNormal

End Sub
```

A.3.2. Export Event

The Export Event sends your data to an Excel spreadsheet. There are many ways to do this. A faster one can most certainly be created. In this example the data set that is exported is small. For larger data sets, you should consider a faster method for implementation. The record set is exported with the following conditional criteria:

JobSpecName = strBatchName
The **JobSpec.JobSpecName** field is the Batch Name from the General Properties Page of the Batch Wizard. This is the name that you give a batch of samples when you start the Batch Wizard.

Sample.IsVolume = True
The **Sample.IsVolume** flag tells you if the user selected a volume on the Sample Properties page of the Batch Wizard. If this value is False, then the user selected a mass. If you have not modified the analyses of the Demo Batch, the samples are in volume units and the Volume input in the Volume input box will be stored in **Sample.Volume**. If **Sample.IsVolume** = False, mass was selected and the correct field to export is **Sample.Weight**.

AnalysisResults.Archive = 0
This is one of the most important fields to understand and we reiterate that when sample analyses are updated, AlphaVision creates a new record for the analysis and archives the previous. Setting this criteria to 0 (zero) ensures that the records that you see are the most recently updated.

AnalysisSpec.ReportActivityPerSampleIndex = 1
This flag sets an index that is tied directly to the choice of activity reporting on the Analysis Misc. page of the Batch Wizard or Update Analysis/Analysis Misc. and Properties pages. If the choice of reporting Activity Per Sample is selected on this page during analysis, this flag is set to 0, and the activity results are found in **AnalysisDetails.Activity**. If the selection is Report Specific Activity, then this flag is set to 1, and the correct results are found in **AnalysisDetails.SpecificActivity**. The uncertainties follow the same convention. Your Crystal Report template provided with the software is designed to deal with these differences and handles the changes in activity reporting selection.

```
'Export Event

Option Explicit

Private Sub cmdExport_Click()

'declare variables to give to the query

Dim strBatchName As String
```

```
Dim db As Database
Dim rs As Recordset
Dim numrecords As Long
Dim numcols As Integer
Dim numrows As Integer
Dim iCnt As Integer
Dim iLoopCnt As Integer
Dim sql As String

strBatchName = lstBatchName.List(lstBatchName.ListIndex)

sql = "SELECT DISTINCT Sample.Name, AnalysisDetails.RegionName, " & _
        "AnalysisDetails.SpecificActivity,
AnalysisDetails.SpecificTotalPropagatedUncPercent, " & _
        "AnalysisDetails.BranchingRatio, AnalysisResults.DetectorEfficiency, " & _
        "HWParameters.LiveTime, AnalysisResults.ChemicalRecovery, Sample.Volume, " & _
        "JobSpec.JobSpecName, Sample.IsVolume, AnalysisResults.Archive, " & _
        "AnalysisSpec.ReportActivityPerSampleIndex " & _
        "FROM Tracer INNER JOIN ((((Sample INNER JOIN Spectra ON Sample.SampleID = " & _
        "Spectra.SampleID) INNER JOIN (AnalysisSpec INNER JOIN JobSpec " & _
        "ON AnalysisSpec.AnalysisSpecID = JobSpec.AnalysisSpecID) " & _
        "ON Sample.BatchID = JobSpec.BatchID) INNER JOIN HWParameters " & _
        "ON Spectra.HWParametersID = HWParameters.HWParametersID) " & _
        "INNER JOIN (AnalysisResults INNER JOIN AnalysisDetails " & _
        "ON AnalysisResults.AnalysisResultsID = AnalysisDetails.AnalysisResultsID) " & _
        "ON (Spectra.SpectrumID = AnalysisResults.SpectrumID) " & _
        "AND (AnalysisSpec.AnalysisSpecID = AnalysisResults.AnalysisSpecID)) " & _
        "ON Tracer.TracerRecordID = AnalysisSpec.TracerRecordID " & _
        "WHERE JobSpec.JobSpecName = '" & strBatchName & "'" & _
        "AND Sample.IsVolume = True " & _
        "AND AnalysisResults.Archive = 0 " & _
        "AND AnalysisSpec.ReportActivityPerSampleIndex = 1 "


Set db = OpenDatabase("c:\Program Files\Ortec\AlphaVision 5\AlphaVisionDemo.mdb")

Set rs = db.OpenRecordset(sql, dbOpenDynaset, dbReadOnly)

'create the spreadsheet
Dim MyExcel As Excel.Application
Dim xlBook As Excel.Workbook
Dim xlSheet As Excel.Worksheet
Dim cellHeaderRow As Integer
Set MyExcel = New Excel.Application
Set xlBook = MyExcel.Workbooks.Add
Set xlSheet = xlBook.Worksheets(3)
MyExcel.Application.Visible = False
Dim cellRow As Integer
Dim cellCol As Integer
Dim intLooper As Integer
    intLooper = 1

    numrecords = rs.RecordCount


'Populate the Excel Spreadsheet with the contents of the Flexgrid
'first, count up the number of columns and put headings on the spreadsheet

With rs
    xlSheet.Activate
        .MoveFirst
            For numcols = 0 To rs.Fields.Count - 1
```

```
                    xlSheet.Cells(1, intLooper).Value = rs.Fields(numcols).Name
                    intLooper = intLooper + 1
            Next
                rs.MoveLast
                numrows = rs.RecordCount
                cellHeaderRow = rs.RecordCount - (rs.RecordCount - 1)
                cellRow = rs.RecordCount - (rs.RecordCount - 2)
                cellCol = rs.Fields.Count - (rs.Fields.Count - 1)

        rs.MoveFirst

'Next put the values in the cells in the grid into the spreadsheet
'use iLoopCount, iStartIdx and iCnt to choose the ones that you want

        Do Until rs.EOF
            For numcols = 0 To rs.Fields.Count - 1
                xlSheet.Cells(cellRow, cellCol).Value = rs.Fields(numcols).Value
                    cellCol = cellCol + 1
                    Next
                    iCnt = iCnt + 1
                    cellRow = cellRow + 1
                    cellCol = rs.Fields.Count - (rs.Fields.Count - 1)
               rs.MoveNext
            iLoopCnt = iLoopCnt + 1

        Loop

    'format the spreadsheet, obviously much more could be done with this

     xlSheet.Columns.AutoFit

End With

    MyExcel.Application.Visible = True 'show it

    rs.Close
    Set rs = Nothing
    Screen.MousePointer = vbDefault

'End If

frmMain.Hide
Screen.MousePointer = vbDefault

db.Close
Set db = Nothing
Set MyExcel = Nothing

Exit Sub


End Sub
```

A.3.3. Batch Search Tool

Searching for batches can be a laborious task for your uploading/exporting personnel. The input box search tool is presented here as an example of ways to simplify and streamline this activity. The tool allows the you to type a few characters and find quickly the batch that you are looking for.

```
Private Sub txtBatchSearch_Change()

'this is a search engine that looks at the characters that the
'user is typing
'here it is used for the txtBatchSearch.Text search engine

Dim Search As String
Dim Length As Integer
Dim Count As Integer

Search = UCase(txtBatchSearch.Text)
Length = Len(Search)

If Length <> 0 Then
    For Count = 0 To lstBatchName.ListCount - 1
        If UCase(Left(lstBatchName.List(Count), _
        Length)) = Search Then
        lstBatchName.ListIndex = Count
        Exit For
    End If
Next Count
End If

End Sub
```

A.4. Notes

The uncertainty can also be reported in activity units by selecting **AnalysisDetails.SpecificActitivityUnc** in the SQL. If the SQL has been modified to report activity per sample units, the correct activity-unit field is **AnalysisDetails.ActivityUnc**.

The program can be modified to include all activity reporting possibilities, and the Visual Basic code modified to export results based on the flags **Sample.IsVolume**, **AnalsysisResults.Archive**, and **AnalysisSpec.ReportActivityPerSampleIndex**. These three important flags allow you to create a very flexible application for exporting results according to your needs.